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Edited by H. H. Brown, A. M. Inst. N. A.
Member Soc. N. A. and M. E.

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"For God's Sake, Hurry Up!"

PERHAPS no phrase better expresses what has been in the minds of countless Americans in recent months than the above plea uttered by the late Joseph H. Choate in his last public address and repeated the other day by Honorable Crawford Vaughn, ex-Premier of South Australia, at the shipping conference of the Chamber of Commerce of the United States. No one better understood the need for haste when we entered the war a year ago than the shipbuilders and shipping men of the country whose intimate knowledge of over-seas transportation problems left no illusions as to the size of the task ahead. "It was useless," said the Secretary of War, "for us to send men to training camps when we had no way of transporting a vast number of soldiers to France." Perhaps so, but why should it have taken a year for the government to come to the common-sense conclusion that better progress might be made in furnishing the means of transportation if a shipbuilder experienced in the construction of merchant ships were placed in charge of shipbuilding operations? With Charles M. Schwab as Director General of the Emergency Corporation we look for a prompt speeding up of merchant shipbuilding. As a former private shipbuilder he controlled some 40 percent of the output of vessel tonnage in this country, to say nothing of being the head of one of the largest steel making corporations. At his call are some of the most efficient and best qualified men in every department of the shipbuilding industry. No further apprenticeship is necessary in this quarter. Action is needed and action of the most vigorous kind can be expected.

A Bigger Shipbuilding Programme

WHILE details of the shipbuilding programme now being considered by the Shipping Board for the coming months have not been made public there is little doubt but that a much larger output of merchant tonnage will be sought next year than has hitherto been contemplated. It may be that the mark will be set at 10,000,000 tons for 1919, with a continuation of this rate of production for 1920. It has often been maintained by shipbuilders whose estimates are worthy of the most careful consideration that a most creditable performance will have been made if 3,000,000 tons of merchant shipping are completed in the United States this year. Whatever the result may be, the great expansion of the shipbuilding industry which will certainly be called for next year means that further shipbuilding facilities must be provided either by the establishment of new yards or the expansion of existing yards. Just as we are going to press contracts for twenty-nine more ships of nearly a quarter of a million tons have been let. When the 730 shipways already provided are operating at maximum capacity and delays incident to non-delivery of materials, lack of housing facilities and the training of shipyard workers are eliminated, something like the real capacity of our newly organized shipbuilding industry will be realized. Rivalry among the shipbuilders for the quickest production of ships and among the various departments in individual yards for records in riveting and in other work is already having a beneficial effect in speeding up the output, particularly so because it gives the individual workmen a chance to win public recognition and receive credit where credit is due. The great need for the rapid expansion of our merchant marine, however, should not be gaged solely by the immediate necessity of transporting troops to France, although this is the first consideration, but it should provide for the carrying on of the world's commerce, upon which all of the allied countries are dependent.

Credit Where Credit Is Due

WITH the resignation of Theodore E. Ferris, after nine months' service as naval architect of the Shipping Board, during which time he designed or passed upon and approved the plans of some 1,200 vessels representing an approximate value of over $1,000,000,000 (£205,000,000), scant recognition has been accorded to a very able man for a record of service never before equaled in the history of shipbuilding. In the practice of his profession as a naval architect, Mr. Ferris early won an enviable reputation as a designer of merchant vessels. Specializing in this branch of shipbuilding, he was entrusted with the design and supervision of many of the finest coastwise passenger and freight steamers under the American flag, ranging from 3,000 to 10,000 tons capacity, for such steamship companies as the Munson, Clyde, Mallory, Ward, New York and Porto Rico and other lines. In this work Mr. Ferris had for years been intimately associated with the leading shipbuilders of the country, and hence it was but natural that when the present crisis arose the Shipping Board should seek his co-operation in the task of creating a great emergency fleet. How ably he met the great responsibilities that were entrusted to him is eloquently attested by the splendid results that were accomplished in the crucial months for the first year of our participation in the war. Notwithstanding the adverse opinions of many of the shipbuilders in the country, Mr. Ferris did not hesitate, after careful investigation, to indorse the so-called fabricating method of building ships which is turning out so successfully in this country and which now promises in part to revolutionize shipbuilding throughout the world. It is seldom that the opportunity comes in professional life to render such signal service as that of Mr. Ferris or to un-

dertake work for the successful accomplishment of which greater credit is due.

Nothing New Under the Sun

IN our April, 1915, issue, there appeared an article by William T. Brown, then master ship fitter at the League Island Navy Yard, Philadelphia, but now assistant superintendent of the mechanical division, Balboa, Canal Zone, which dealt with certain standardization methods of ship construction and the application of multiple punching, features which, in reality, covered all the essential details of the present-day methods of building so-called fabricated ships. So far as is known, this was the first article published in which the application of these particular methods to ship construction was suggested. Like all pioneer work, however, the thought and idea were too far advanced for shipbuilders at that time, but now, due to National necessity, when it has become essential that some method of intensified production must be developed, the idea first advanced by Mr. Brown has been incorporated and is now being used with marked success. That there is "nothing new under the sun," therefore, applies to the fabricated shipbuilding idea as well as to many other lines of development in the engineering field.

Community Aid for Shipbuilders

IF the shipbuilders are to succeed in carrying out their gigantic shipbuilding programme, they must be given every aid and assistance possible from the communities in which the shipyards are located. This fact was recognized early in the period of the war by the Chamber of Commerce of the United States and a War Shipping Committee was organized to co-operate with the United States Shipping Board and to secure the aid of the shipbuilding communities. To bring the shipbuilders and the business men of the shipbuilding communities into close co-operation, war shipping committees were appointed in every shipbuilding district throughout the country and an office with a competent staff was established to keep in touch with all these committees and to send out to them from time to time suggestions for new lines of helpful activity. That much has been accomplished in this respect by the National Chamber of Commerce was brought out at its recent annual convention in Chicago. The War Shipping Committee began in a small way at first by suggesting and then providing a badge for ship workers which would give them recognition as war workers throughout the community and thus lead them to feel that they were doing their share, although not in uniform, or at the front. Next, posters were provided, appealing for shipyard workers, placards were furnished to be attached to ship material in transit and steps were taken to organize a reserve of shipyard workers, a branch of the work which was soon taken over by the Government, solving one of its most important problems. Every effort was made by arranging meetings, providing speakers, displaying pictures, etc., to arouse patriotism and zeal and stimulate the shipbuilding community to co-operate with the shipbuilders and supply without delay whatever assistance might be needed, whether in the housing or transportation of shipyard workers or furnishing help and supplies.

As an example of how effective this work could be made, the work of the War Shipping Committee of the Merchants Association of New York can be cited. In the New York district there are twenty shipyards working on Government contracts. On January 1 they were employing about 30,000 men with the prospect of having nearly double this number by the middle of the summer. Taking up only non-technical problems connected with shipbuilding, it was first found necessary to secure a satisfactory supply of labor. Coupled with this was the problem of the erection of additional houses in the vicinity of the shipyards; the construction of new transportation facilities and improvement of existing facilities; the installation of schools for training unskilled and semi-skilled shipyard labor; the return to the shipyards of skilled men taken by the first draft; the exemption of skilled workmen from future drafts and a uniform employment policy to assure a creditable and sufficient supply of labor at all shipyards and the elimination of so-called stealing of labor. All of these problems and many others were given immediate and energetic attention, with the result that the shipbuilders received substantial aid in speeding up their work.

Should Business Men Help the Transference of Their Skilled Employees to Shipyards?

IN discussing the above subject at the recent annual meeting of the Chamber of Commerce of the United States, one member who had just visited twenty-five shipyards on the South Atlantic and Gulf coasts pointed out two needs that have materially retarded ship construction. First, the shipbuilders did not receive material as fast as they needed it, and second, the shipbuilders were unable to secure anything like as many skilled ship workers as they required. It appeared that the lack of skilled workmen had more to do with the slow progress than anything else and constituted the real handicap in the rapid building of ships. Recognizing this difficulty, a remedy was proposed, which, it was believed, the business men of the country could supply. The remedy was simply this, that the business men in non-essential industries be urged to send the most efficient executives and skilled workmen to the shipyards when and where they are needed to speed up shipbuilding. While it is true that not every executive or skilled workman may prove competent in the actual work of shipbuilding, nevertheless such a plan would mean that at least men who have attained success in their own special lines of endeavor will be available for use if needed, and it is safe to assume that a man who is either a competent executive or a skilled workman can accomplish better results in the highly specialized work of shipbuilding than ordinary or semi-skilled labor.

Fabricated Method of Shipbuilding Proving a Success

IN a recent letter to Henry R. Sutphen, vice-president of the Submarine Boat Corporation, Theodore E. Ferris, former naval architect of the Shipping Board, has the following to say regarding the fabricated ships building at the company's yard:

"The work as a whole, and much to my surprise, is better than that usually turned out in the shipyards under the old tradition method of steel ship construction. From what I have seen at your yard on the work now advanced, there is absolutely no question in my mind as to the success of the fabricated method in steel ship construction. This method will be a revelation in steel ship construction over the old tradition methods. As you were the pioneers, and had the foresight to see its possibilities, certainly great credit is due you."

Directors of Merchant Shipbuilding in the United States and Great Britain

(Copyright by Press Illustrating Service, N. Y.)
The Right Honorable Lord Pirrie, K. P., Controller-General of Merchant Shipbuilding in Great Britain

WITH the appointment of Charles M. Schwab as Director General of the United States Shipping Board Emergency Fleet Corporation, and the Right Honorable Lord Pirrie, K. P., as Controller-General of Merchant Shipbuilding in Great Britain, the two foremost shipbuilders in the world now control the output of merchant tonnage in the two greatest maritime nations. Both of these appointments have been received with universal satisfaction by the allied nations and there is every reason to believe that the rate of production of merchant vessels will speedily be increased.

Mr. Schwab takes up his duties as master shipbuilder in America as a fitting climax to a life of personal achievement, unique in the history of a nation of master builders. Measured in the ordinary terms of success there is little that Mr. Schwab has attempted that has not been done, and done well. It is for this reason that in this supreme crisis he has been chosen to undertake the gigantic task of getting into service, in the shortest possible time, the largest possible fleet of merchant ships.

Lord Pirrie, Great Britain's foremost shipbuilder and shipowner, is the head of the great Harland & Wolff shipyard and its subsidiaries. As Controller-General of Merchant Shipbuilding he brings to the British government the most experienced and most highly qualified advice and assistance for carrying out its shipbuilding programme. Lord Pirrie will not become a member of the Board of the Admiralty but will have direct access to the Premier and the War Cabinet.

(Copyright by Underwood & Underwood, N. Y.)
Charles M. Schwab, Director-General of the Emergency Fleet Corporation

"What the Shipping Board Has Done"*

Comprehensive Analysis of Merchant Shipbuilding Situation in the United States—Progress of the Work

BY EDWARD N. HURLEY†

IF by the exercise of magic a bridge could be thrown across the Atlantic over which our armies, their artillery and supply trains could move rapidly and unhampered to the battle lines in France, would any military man in Berlin, Vienna, Rome, Paris, London or Washington have any doubt but that the world would be made safe for democracy before the year goes out? We have the men, we have the guns, we have the supplies. But without means of getting them to the front we might as well be without them. And unless we get our men to the battle line we will not win this war.

So it all comes back to ocean transportation—to the vital need of ships. Fail there and we fail utterly. Upon the Shipping Board has devolved the responsibility of supplying this need, and supplying it under the most extraordinary conditions that ever existed,—supplying it at the most crucial period of the war's history, at a time when every other industry is being taxed to its utmost capacity in the matter of materials and labor to provide war necessities.

Handicaps

The handicaps have been many. We were not a maritime nation. Our flag had almost vanished from the seas, and with the exception of a few widely scattered shipyards, merchant marine construction had almost become a lost art with us. Then came this sudden call to outdo the rest of the world in the upbuilding of a merchant marine; a call coming at a moment when the Navy was undergoing the greatest expansion in its history—when most, if not all, of the established yards were feverishly engaged in rush construction on dreadnaughts, destroyers, submarines, fuel ships, tenders and other auxiliary craft, and when munition makers were absorbing that part of skilled labor which had not been called to Government navy yards or private shipbuilding plants. So it was a case of not only working from the ground up, but of first securing the ground upon which to make a start, some of it, marsh land, which had to be filled in before launching ways could be laid.

When we took hold of this job of shipbuilding, we found there was no shipyard in existence with which we could place an order. The old yards, with their trained force of shipbuilders, were filled to capacity. Seventy percent of their space was taken by the enlarged naval program. The remainder of the space was taken by the orders which had been placed by American owners, and by foreign owners, who, pressed for more ships, had filled the yards of America to overflowing.

Creating a New Industry

We were faced with the necessity of creating an entirely new industry. We had to establish the yards first, get the shipbuilders to take charge of them, and train the men to build the ships. There were 37 steel shipyards in America at the time of our entrance into war. We have located 81 additional steel and wood yards, while 18 other yards have been expanded. We are building in the new and expanded steel yards 235 new steel shipways, or 26 more than at present exist in all of the steel shipyards of England. The new industry we have created will make America the greatest maritime nation in the history of the world.

Struggling against something that cannot be avoided is more baffling than struggling against something that can be. You can appeal to striking men to go back to work, but you can make no appeal against zero weather. We did what we could. We told the new shipyards to go ahead and use dynamite in locating their pilings. The men in those yards fought the bitter winter. They had the same spirit, and demonstrated the same pluck and unselfishness as the men in the trenches. And they have virtually completed the job of building America's new shipyards—the new yards that will make us the greatest shipbuilding nation.

Shipbuilding Records Established

It has been an uphill struggle, but we have had our moments of elation when we have felt that we are making progress. The record made by the Skinner & Eddy Company of Seattle is a case in point. That company laid the keel for an 8,800-ton vessel, which was launched in 64 days. She was delivered to the Fleet Corporation on January 5 and started on the first voyage on January 14. This record accomplishment shows what can be done in live, wide-awake efficient American shipyards.

Then a few days ago we received a telegram from the Moore Shipbuilding Company of Oakland, Cal., announcing the successful launching of one of their large vessels. Twenty minutes later we received another telegram from the same company announcing the launching of a second ship of the same type, and forty minutes afterward a third telegram saying that a third vessel of similar character had gone overboard. This was the record of one American shipyard. The launching of three 9,400-ton vessels in a single afternoon—an accomplishment which I believe is unrivaled in the world's annals of shipbuilding.

The total amount of our steel construction on March 1 was 8,205,708 deadweight tons. This is made up of 5,160,300 deadweight tons under contract with the Emergency Fleet Corporation, and 3,045,408 deadweight tons of requisition vessels.

Progress of the Shipbuilding Programme

Of this total steel construction, 2,121,568 deadweight tons, or approximately 28 percent, has been completed. That means that in addition to the building of our big new yards we have also been building ships. That is, the program for steel ships has advanced 28 percent toward completion. Of the amount of steel ships under contract and under requisition, 655,456 deadweight tons, or approximately 8 percent, were actually completed and in service on March 1 of this year, nearly a month ago. This amount of floating tonnage exceeds our total output in 1916, including steel, wooden and sailing vessels, by approximately 50 percent.

Notwithstanding the difficulties of organization, the handicaps of bad weather conditions, transportation em-

*From an address before the National Marine League, New York, March 26.

†Chairman of the Shipping Board.

bargoes and railroad congestion, nearly as much tonnage has been constructed in American waters in the past three months as by all the other maritime nations of the world combined.

We have had to build up a tremendous administrative organization, with expert naval architects, expert traffic and operating heads, and at a time when the demand for such talent greatly exceeded the supply. We have had to negotiate for neutral tonnage. We have had to requisition and provide for the operation of the entire existing American merchant marine; we have had also to provide skilled supervision for the repairs of interned German ships which were seized.

The Germans thought that by crippling their own vessels in American waters they would be able to prevent us from using them. American ingenuity and resourcefulness gave the answer by restoring these vessels to efficiency. With the expenditure of a little less than $8,000,000 (£1,650,000) we have succeeded in placing in our war service and in the service of the Allies 112 first-class German and Austrian vessels representing a carrying capacity of nearly 800,000 deadweight tons.

At the outset the 37 old steel yards began increasing their capacity until they now have 195 ways as against 162 eight months ago. Other parts of their plants have increased proportionately. We then made provision for additional new steel yards, some of which have been given financial assistance by the Emergency Fleet Corporation. Thirty additional new steel shipyards are thus being erected, with a total of 203 shipbuilding ways. Thus we now have in the aggregate 67 steel shipyards either wholly or partly engaged in Fleet Corporation work. These yards will have a total of 398 steel building ways. Of these, 35 yards with 258 ways, are on the Atlantic and Gulf Coast; 19 yards with 6 ways are on the Pacific, while 13 yards with 74 ways are on the Great Lakes.

Wooden Shipbuilding

Our program for building wooden ships has been beset with many difficulties and handicaps which could not well be foreseen. A year ago, wooden shipbuilding in the United States was almost a lost art. We found 24 old wooden shipyards, with 73 ship ways. The capacity for wooden shipbuilding has been increased until we now have 81 wooden shipbuilding yards, with 332 ways completed or nearing completion.

Assuming that these ways will each produce two standard ships per year we should turn out about 2,300,000 deadweight tons of wooden ships annually. These 332 wooden shipbuilding ways, now nearing completion, added to our 398 steel building ways, will give us a total of 730 berths upon which to build steel and wooden vessels. When you consider that we had only 162 steel building ways a few months ago and 73 wooden shipbuilding ways —a total of 235—an increase is shown of 495 wooden and steel berths on which we can build ships.

With our total of 730 wood and steel ways, we will have 521 more berths than Sir Eric Geddes in his recent speech stated England has at the present time.

From the transportation standpoint, we must expect absolute freedom in the movement of our materials: otherwise the speeding up of manufacture is wasted, and consequent delays in finished ships will result. We look to the Railroad Administration with full confidence that they will supply our needs in this respect.

Turbine and Engine Manufacture

The situation giving us the most concern is the completion of turbines and engines. The very rapid expansion of the shipbuilding program caught the turbine and engine manufacturers totally unprepared. Special tools of all kinds were required for the engine builders' shops, and these tools had to be secured from manufacturing shops already overcrowded with war orders. In addition to this, the severe weather and the transportation tie-up seriously delayed the construction of some of our largest turbine building plants. We anticipated delay during the earlier months for lack of the turbines and engines, but expect to make up for the early shortage.

The proposal to build ships of concrete was first regarded as a fascinating absurdity. On March 14 there was launched from the yards of the San Francisco Company the first concrete steamship, a vessel which the builders christened *Faith*. We hope she will exemplify her name.

Labor—Our Strong Right Arm!

Now as to labor—Our strong right arm! There has been much talk of conscripting labor, of forcing it into shipyards as our soldiers have been brought into the camps. I wish to put myself on record as being opposed to the conscription of labor. I do not believe conscription necessary, for I believe labor itself will produce conditions which will render idle all thought of conscripting workmen. The vast majority of our workmen are men of intelligence, and when they come to a full realization of the fact that any defection on their part now will not only imperil the nation, but will injure their fellow workers in almost every field of industrial activity, I feel sure they will respond to all demands made upon them. Unless they fully do their part, their brothers will suffer.

It would be useless to manufacture material and supplies and pile up the products on the wharves if there are no ships to transport them. So, unless our ship workers do their best, other industries must slow down or halt completely, with the result that thousands of workers throughout the country will suffer for lack of employment.

I believe that labor has begun to realize that fact, but I want to drive it home to them; for there are some, I regret to say, who do not yet sense their responsibility. There are many who are not working to their full capacity. There are many who, because of the high wages they are earning, are prone to take too many holidays. Labor generally throughout our shipyards is to-day receiving the highest rate of wages ever paid for similar work in the history of the world. The additional cost of our ships, due to increased wages in shipyards covering the programme we have mapped out, will be in excess of $300,000,000 (£61,500,000). We expect, and we have a right to expect; the country has a right to expect, that labor will render for this increase of wages a corresponding increase in production—that is the output of ships.

Inefficient Shipyard Owners

There have been inefficient shipyard owners, as well as inefficient workmen. Where there is an inefficient owner, who does not understand the viewpoint of labor and who thinks only of his profits, labor has a right to complain. We intend to know what the costs and the profits are in every yard. We feel that the public is entitled to this information.

We have felt that it was our duty to see to it that the problem of housing the workmen in these vast new plants we have been creating was solved with care. The cost-plus system has been banned by Congress in the housing operations, because Congress itself, as well as the rest of us, have felt that there should be a greater check, not

merely upon profits, but upon the actual cost of all work done for the Government.

Training Workmen

The new yards have been established, wherever possible, away from the congested districts, and while this was necessary, it brought with it the problem of transportation, as well as of housing. We are arranging now for proper transportation, as well as for proper housing.

Training of new workmen for the yards has, in itself, proved a difficult task, but we are accomplishing it. We have established a large training school at Newport News to which 247 skilled mechanics, selected from 22 yards, have been detailed for a six weeks' course of intensive training to fit them as instructors for recruits brought into the various shipyards. Our latest report shows that 115 of these have completed the course and have been sent out as instructors. These men represent 16 trades. The men who are taking this instruction course will be capable of training an industrial army of 37,000 men. A department of training electric welders has also been established.

We have recruited a volunteer force of 250,000 highly skilled mechanics who have, with a patriotism that has made us all proud, agreed to hold themselves in readiness for our call. These men are being held in reserve in their present employment until such time as in the development of our yards the demand arises for their services.

Government Assembling Yards

In referring to what have been popularly termed our three fabricating shipyards, these assembling yards, with their 50 ways at Hog Island, 28 at Newark Bay, and 12 at Bristol, will, when they are in full operation, produce in a single year more ships than England, the greatest maritime nation of the world, has ever been able to turn out in the same length of time. Already at the yards of the Submarine Boat Company at Newark Bay, 15 keels have been laid, and 13 more will be put down as soon as the remaining ways, now in course of construction, are completed. By the time the last way is finished the vessel on the first way will be well on towards completion; and as soon as it is slipped into the water another keel will be laid in its place, and we will thus have a continuous series of vessels dropping into the water from this yard at the rate of two a week. Even greater tonnage will be produced at Hog Island, with its larger number of ways and the bigger type of vessels which are being constructed there.

When the high point in the curve of production finally is reached, and the magnitude of America's shipbuilding program is realized it will be a continuous performance of production and launching. There is no doubt but that we are destined to be one of the leading shipbuilding nations in the world.

Our Future Position

We will have the largest number of shipyards, the materials and the labor and when our shipbuilding plants are completed and are well organized on sound business lines so as to produce ships cheaply and rapidly, we will not only produce sufficient ships to become the leader in the commerce of the world by furnishing transportation at reasonable rates, thereby performing a service to the rest of the world, but we will build ships in such large numbers and at such fair prices that we will become the mecca of the shipbuilding trade of the world.

I have outlined the entire situation—in utmost frankness—concealing nothing, for we have nothing to conceal. Shipping is the essence of the struggle in which the world is now engaged—the central beam in the whole war structure. If that fails, all else fails. We are engaged in a race with the submarine. We, of the Shipping Board, are alive to the needs of the situation. The whole Government in Washington is alive to it, and there is complete coöperation to bring success in this greatest task to which America has set herself.

Standard Ships and Engines

THE Shipping and Shipbuilding Industries Committee of Great Britain has submitted its report on standardization, from which the following is taken:

Standard vessels and standard engines have been designed and are being built by a large number of firms, and the experience gained so far indicates that under normal conditions successful results might be achieved on similar lines. It should, however, be borne in mind that after the war efforts at increased standardization will rest with individual builders, and not with the Government. Standardization had been carried to considerable lengths before the war in details of outfit, and even to the extent of building complete standard designed vessels. Generally, however, standardization had been carried out works by works, and naturally in ordinary cargo boats alone. As in the case of the hulls of cargo vessels, so with marine engines, a considerable amount of standardization has been effected within the works of individual firms building marine engines, and we learn from the evidence of one of the witnesses that an effort is being made further to standardize marine engines of the reciprocating type for cargo vessels. This standardization has taken the form of a guidance specification, and is being drawn up under the auspices of the North-East Coast Institution of Engineers and Shipbuilders. In any type of engine such as is adopted for the plain cargo boat, where the general design is similar, differences being chiefly of detail, the universal use of such a specification should tend to an increase and cheapening of production.

In its recommendations the committee says:

"We view any movement towards standardization with satisfaction, and we are of opinion that further effort should be made to secure progressive standardization in all directions. We are aware of the very valuable work which has been done by the Engineering Standards Committee for the benefit of shipbuilding and marine engineering, in which work shipbuilders and engineers have taken a large part, and we therefore recommend that the Government suggest to shipowners, shipbuilders and marine engineers the desirability of forming a joint committee under the Engineering Standards Committee to consider these proposals. Shipbuilders and marine engineers who gave evidence before us considered that the question of increased standardization of production depended largely upon shipowners and their marine superintendents, and that it had not hitherto been practicable to carry it so far as it could have been had shipowners and their technical advisers been prepared to forego insistence on their own ideas in general design and details. It is for this reason that we recommend that shipowners (or their representatives) be joined with shipbuilders and marine engineers on the above Standards Committee. We recognize, however, that even so far as cargo-carrying vessels are concerned the extent of standardization as to dimensions and general design must necessarily be limited in ordinary peace times by difference of the draft of water at various ports, variations in the methods of loading and discharging cargo, the nature of the cargo itself, speed requirements, etc."

How Can We Build More Ships?*

Government Agencies and Shipbuilders Must Work Hand in Hand—Sympathetic Relations Necessary

BY JOSEPH W. POWELL†

IN 1914, the year that the war broke out, the entire production of ships in this country was no greater than will be turned out and delivered to the Shipping Board in this present month of April. It was in 1916 that the demand for tonnage really began to be acute, and when the growth of shipyards and shipbuilding really commenced. The year before, in 1915, we had finished something like a half million tons. In 1916 we increased the production to about three-quarters of a million tons, and in this last year, 1917, the total production was about a million and a quarter tons. Those of us who have studied the proposition carefully believe that during the present year, if things do not break too badly, the industry may turn out three million deadweight tons of ships. No nation has ever yet succeeded in adding as much as two million tons in one year to its previous high-water mark of production. In December last the five yards of the Bethlehem Shipbuilding Corporation had some 27,000 employees engaged in shipbuilding. This number has increased, until to-day we have about 47,000, and if we are able to maintain our rate of increase we figure that by the middle of December we will have about 60,000 men. In December our rivet driving, which is more or less a barometer of production, ran about 900,000 of rivets a week. For the last two weeks, of which I have record, we have run about 1,400,000 rivets. Put in terms of ships, this means two big merchant ships a week, or something over one hundred in the course of a year. Put in tons of ships, if these were all on merchant tonnage it would mean in the neighborhood of 900,000 to 1,000,000 tons deadweight of merchant shipping. Of course, the navy has absorbed in the neighborhood of half of our productive force for its work, and most of the other old line shipyards are equally giving up to that branch of the service an even larger proportion of their capacity. So that the large demand for new merchant tonnage brought about by the war must be handled to a great extent by the newer yards and the yards that are made up of people who are largely new to shipbuilding.

Shipbuilding Controlled by Government

To-day shipping is a controlled industry. The materials that go to make up the ships are allotted to us by the War Industries Board, and the wages that we pay our men and the conditions under which they work are prescribed by the United States Wage Adjustment Board. The prices that we receive for our ships are set by the Government, because all our work is for one department or another of the Government. Our transportation, of course, is subject to the Government's regulations for the handling of the railroads, and financing is possible at this time, so that anyone that wants money must call on the Government for their needs. The net result of all of these items is that there alone remains to the shipyard that vitally important function of management without which everything else means chaos.

But we are in the position where each of these various Government activities must function together with our management or shipbuilding will fall down. If transportation fails again, as it failed in January and February, if the control of our labor is not properly handled, and if the materials are not properly allocated, then the shipbuilder cannot hope to make good on the programme that he has undertaken. We, therefore, have the curious anomaly of a situation where the Government, in crying need of ships, controls in a vital way the various items that are essential in its production, and where none the less the shipbuilder who has to be called on to build ships must do his part or we cannot hope for a successful outcome of this war.

It is, therefore, clear that the one answer to the question, how can we build more ships in the next six months? is not far to seek. The most essential and most vital thing at the present time is to establish and maintain the closest of relations between the various Government agencies controlling the vital features essential to the carrying out of our work and the shipbuilders. If we cannot have this close association and if we cannot have a thoroughly sympathetic relation with Washington and the powers that be there we cannot hope for the best results.

Close Co-operation Between Government and Shipbuilders Essential

It is primarily at this time a necessity that those in charge at Washington should recognize this absolutely essential feature, that the shipbuilding industry should be called into conference on all occasions, and that as far as possible the practical experience of the men who have built ships for many years shall be used to the limit in the prevention of mistakes at the source, that will surely show in the output that can be expected from the yards. There has been a very considerable advance made in this direction in the last few months. Mr. Piez, vice-president and general manager of the Emergency Fleet Corporation, sits practically every two weeks with a committee of shipbuilders, and has shown a thorough appreciation of the necessity for knowing the troubles that come to our business, first hand.

It is rather unfortunate that in a large and newly made organization such as the Emergency Fleet Corporation there are so many men in subordinate positions who have been clothed with no inconsiderable authority and who have not yet appreciated that point of view, and it is going to be one of the most difficult things that confronts us at this time to make that big organization into one that will function as those at its head desire, and as those of us who work with it appreciate it must function if we are to produce results.

The question of financing is one that is touching practically every shipyard to-day, as this business of shipbuilding expands. The amount of money that is soaked up in carrying on the business is something that no one who has not taken part in a big business expansion can appreciate.

I find in talking to the various heads of the different shipyards that the experience is almost universal. The question of their bank balances is becoming more and more a vital one. A great load could be taken off from their shoulders by the Government by some system of financing that would relieve them from this portion of their business burden.

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* From an address before the Chamber of Commerce of the United States, Chicago, April 11.

† Vice-president, Bethlehem Shipbuilding Corporation.

In every shipbuilding community there are so many things that a Chamber of Commerce can do that will really help the shipbuilder that it is hard to list them in a few minutes. The question of housing, the question of transportation, the question of men, material and equipment are all questions with which the chamber of commerce is eminently fitted to deal. The question of showing the workmen that they have been set apart for a wonderful task at this time is one that can be carried on by this body with, I believe, the greatest good to shipbuilding as a whole.

I have maintained for many months that we must find some way to reach the men in the community through the women and children. I believe the organizations of the women and the organizations of the children and their instruction as to what this war means to them, can be carried back through the family to the workman in a way that will produce results almost beyond our expectations.

Work of Business Organizations Must Be Systematized

Efforts by the Chamber of Commerce must be systematized. We have had one sample only recently where almost hundreds of well-meaning citizens have nearly swamped the management of one of our plants in their endeavors to help in the housing proposition. If each local Chamber of Commerce would organize a committee to take up all the multitude of questions in which the shipyards can be aided and should arrange for meetings at stated periods with the shipbuilding management, the labor of the details can be taken off from the management, and at the same time the forces of the community can be brought together in orderly array to the help of the shipbuilders.

Physically our industry is quite prepared for a greatly increased shipbuilding programme. The labor is available. Its absorption into the industry and its training is going on at a very rapid rate.

The material situation, which is now becoming seriously menacing, is one which, if properly handled from Washington, can be straightened out, because sufficient material is available to provide us with what we need for our work. Fuel and transportation are also in hand, if priority to shipbuilding is given.

The plant management and the Government are equally anxious to perform, but there is still a great deal that needs to be done to assure that harmonious inter-relation without which great efforts can be very futilely expended.

Financial Assistance a Vital Question

Financial assistance is going to become increasingly a vital question as the volume of work becomes larger and larger, and, lastly, this community effort about which I have spoken is necessary to build up the spirit of our workmen to the point of view that will help more than anything else to produce the quantity of ships that we must have to do our part.

The time has come to cut out criticism, recriminations and bickering. For the shipbuilder to accuse the Government of not doing its part is not going to build ships. Neither is it going to build any ships for the Government to accuse the shipbuilder of falling down.

We know the Government is earnest. We know the people with whom we deal are as earnest in this matter and as fully alive to the necessities as any men can be. The shipbuilders are equally alive to the essentials of the situation. But to produce results we have got to get together and do the work. It is going to be this pulling together that will produce the volume of ships that we must have to carry on our part in the war.

The Shipyard Labor Problem*

BY MEYER BLOOMFIELD†

I HAVE just come from a tour of all the shipyards of the Pacific Coast, from Los Angeles to Seattle, having not only spent hours in the yards but days in conference with citizens' committees, the different Chambers of Commerce, the different Chamber committees and the representative of all the shipyards in every city, the bankers, shipbuilders and others interested in this one supreme problem of the present hour. The Pacific Coast is building ships fast and well. The most inspiring fact which I came upon in the entire visit is the spirit of labor on the Pacific Coast.

I have a mass of letters written to me while I was on the Pacific Coast by the workmen. The burden of their complaint is, "We have not enough work to do." There has been some delay in material, perhaps; a turbine held up on the road; material flagged somewhere and perhaps forgotten. The men, apparently, from all the evidence, want not only to do their bit, but, as Mr. Hurley recently put it, "do their all."

In October, when we began to keep records of the number of men employed in our shipyards, there were 102,000 employees. On April 8 there were 270,000 employed in the shipyards of this country. What the weather did to us in the East last winter can best be seen by the fact that the daily attendance in many of the Delaware River shipyards fell off to 50 percent. On the Atlantic Coast, from last November to date, and on the Pacific Coast, the daily attendance has been around 90 percent.

By centralizing all shipyard employment in Seattle—by agreement among the shipbuilders to use a public labor exchange, where craftsmen do the selecting of men for the shipyards—the turnover of labor in the shipyards there has dropped enormously. The waste of time in looking for a job or in going from gate to gate has been eliminated. Only two of the yards that I saw on the Pacific Coast could be spoken of as old yards, and yet they have multiplied their ways from a few to many so that they will turn out 400 ships on the Coast. I have seen shipyards on which the production will be 40,000 tons per way per year. That is an efficiency that has never been reached in the shipbuilding history of the world. They are doing it now. They are also doing it in some of the yards on the Atlantic Coast.

What is doing it? It is honest, frank, unqualified co-operation between the management and the men. When men have to wait for material or for tools or for air power, that is a problem for the management to solve, and the managers are trying to solve it better and better. But when men skulk and don't do their bit, everybody must take a hand in the discipline of these men, because they are committing a crime against the country and not against the shipbuilder himself. Every shipyard worker is now working for one employer—that is the United States Government. And this Government expects humane treatment, fair play and recognition of manhood in foremen, managers, riveter and heater boy. The management and the men have come to the consciousness that they are really working for themselves; they are working for their Government, and their Government expects 100 percent loyalty, 100 percent energy, 100 percent intelligence and 100 percent co-operation.

* From an address before the Chamber of Commerce of the United States, Chicago, April 11.

† Industrial Service Department, United States Shipping Board Emergency Fleet Corporation.

Housing Our Shipyard Workers

**Shipbuilding Delayed by Lack of Housing Facilities—
Problem Involves Transportation of Shipyard Workers**

BY WALDON FAWCETT

SPEED in building merchant ships in the United States will be directly dependent upon the provisions of adequate living quarters for the shipyard workers. Recognition of this fact is responsible for the energy with which the housing problem, so called, has been attacked by the United States Shipping Board Emergency Fleet Corporation. It is, in effect, the mainspring of the project which aims to create, by the late autumn of 1918, residential communities at eleven or more shipbuilding centers where operations have been handicappd, if not definitely restricted, by inability to billet shipbuilding artisans on the communities.

It is not too much to say that the success of the U. S. Shipyard Volunteers' movement and the solution of some of the most difficult labor problems of the shipbuilders are directly dependent upon the execution of the housing programme, formally sanctioned in April by the Congress of the United States. This is no mere adventure in industrial community development, with the object of cultivating contentment among the shipyard operatives (although that is an incidental consideration), but is an important and imperative feature of the broad, constructive plan. By the summer of 1918 some of the most efficient shipbuilding plants will have reached the point where it will be impracticable for them to take on additional employees, however sorely needed, unless housing facilities for the newcomers shall have been provided in the meantime.

Scope of the Housing Department

The lately created housing department of the Emergency Fleet Corporation operates under the provisions of a very comprehensive special statute enacted by Congress and which authorizes the Fleet Corporation to not only acquire land and buildings, but likewise to sell such real estate. This latter authorization is important, because it is the intention of the Fleet Corporation, in so far as possible, to induce the ship workers to purchase, by instalments in lieu of rent or otherwise, the dwellings provided for their benefit. It is possible that there may be a factor of discouragement to this plan in the circumstance that high material prices which will cause the standardized four-, five- and six-room houses to cost more than had been anticipated, but, inasmuch as rentals will likewise have to be based upon these higher costs, it is hoped that a large proportion of the married men can be induced to own their own homes, with all the guarantee of permanency which such acquisition carries.

The special legislation under which the Emergency Fleet Corporation has undertaken its housing project places at the disposal of the Corporation for this operation the aggregate sum of $50,000,000 (£10,250,000). There is conferred, incident to the other powers bestowed, autocratic authority to requisition existing buildings and property adjacent to the shipyards suitable for housing purposes, but it is the present intention of the Fleet Corporation to commandeer dwellings only under what might be accounted exceptional circumstances. For various obvious reasons, it is accounted preferable to provide the shipyard operatives with new modern dwellings, designed as a result of a close study of the needs of the average family in the industrial environment involved and with each residence made a part of a harmonious community development that will in due course encompass recreation centers and other features of twentieth century urban life.

Basis of the Housing Contracts

For all the latitude given to the Emergency Fleet Corporation with respect to the construction of habitations for ship workers, the law does impose certain limitations with respect to entry into any contract providing for compensation to a contractor on the basis of cost of construction plus a percentage thereof for profit. As a result, perhaps, of these limitations, the housing contracts of the Fleet Corporation are on what is commonly known as the fee basis or commission basis, rather than upon the cost-plus plan, as it is usually applied. In erecting homes for ship workers the private contractor furnishes contract equipment and hires the labor, but Uncle Sam pays the labor costs, as well as material costs, and pays to the contractor a fee that does not increase pro rata with the total outlay on the project. This latter plan was, when followed in the construction of army camps and cantonments, objected to as offering a temptation for the inflation of costs, and consequently there were in Congress expressions of disapproval upon this plan as a working arrangement for housing construction at the shipyards.

Passenger Transportation Involved

When it was announced before the middle of April that estimates had been secured on the construction of 1,000 houses at Camden, N. J., and 1,600 houses at Hog Island, the indication of progress was gratifying to persons who realized that the preliminaries of this housing responsibility involve something more than mere approval of architectural designs. As an indication of the complex character of the problems grouped under the head of housing, it may be mentioned that at every scene of housing operations it has been necessary to make very thorough investigations of the passenger transportation problems affecting the ship workers at the different plants. This investigative work which has resulted in many instances in the re-routing of railroad trains or electric cars or the rearrangement of schedules and improvement of transportation service has covered Hog Island, Camden, Gloucester, Newark Bay district, Staten Island, Elizabeth, Savannah, Ga., Sparrow's Point, Baltimore, Portsmouth, N. H.; Bath, Maine; Quincy, Mass.; Groton, Conn.; Newport News, Va.; Port Jefferson, Newburgh, N. Y.; Chester, Wilmington and Bristol, Pa.

The execution of the housing programme is to be administered from Washington, where, as an integral of the central office organization of the Emergency Fleet Corporation, there has been created at 612 F street, N. W., a housing department. The housing department is essentially a section of the national service division of the corporation, which handles all welfare and industrial service work, and J. Rogers Flannery takes on the title of director

of housing in addition to that of manager of the national service division. Within the housing department a complete organization is being created, and there is more or less co-operative work. For example, in studying the problems of passenger movement affecting shipyard workers, the housing department has had the assistance of the transportation division of the Fleet Corporation, whereas Director of Production Robert Kohn, of the housing department, has in the selection of architectural designs for ship workers' homes had the benefit of the judgment of an advisory board of architects.

Design of Houses Not Universally Standardized

With the Emergency Fleet Corporation so largely committed in its ship construction programme to standardization of design, it is interesting to observe that in disposing of the housing problem this principle will not be universally adhered to. That is to say, while standardization of architectural design will prevail to a considerable extent in each shipyard community, the various communities are to be indulged in their individual or distinctive tastes with respect to forms of construction. Thus we will find at some yards brick dwellings exclusively (though this construction is in part dictated by fire regulations in cities such as Philadelphia), whereas at other yards frame residences will predominate, and at yet others stucco will prevail. In each instance an effort has been made to conform to local custom and the preferences of the main body of prospective occupants as disclosed by a first-hand investigation. On each project the aim will be to attain the same ideals of comfort and convenience regardless of the size of the house, so that each household in the community will enjoy an even equivalent in domestic advantages, even though some of the houses be half as large again as others.

Whereas the Emergency Fleet Corporation will incorporate as a feature of each extensive housing undertaking the erection of dormitories for the use of the single men in the shipbuilding community to be served, attention is to be concentrated upon the provision of individual family dwellings. Because of the uncertainties of the ultimate requirements of the military draft, added to the other considerations that have always obtained in connection with shipyard operation, shipbuilders are particularly anxious to recruit as large a proportion of the forces as possible from the older men—the married men. Temporary buildings, except under exceptional circumstances, are not favored. Experience has proven that even the unmarried ship workers resent assignment to habitations of a makeshift character. Discussing this phase of the subject recently, George J. Baldwin, chairman of the Board of the American International Shipbuilding Corporation, said: "When you come to get your expert men —your riveters and iron and steel men—they are not willing to live in what is virtually a poor barracks. They have to have better housing."

Shipbuilding Programme Retarded by Lack of Housing

The comment of Chairman Baldwin that his company would have to await housing facilities, provided through governmental aid, ere it could hope to attain its peak load of 29,000 employees in the yard, is paralleled by reports that have been sent to Washington from various private shipbuilding plants throughout the country. Months ago the management of the yard at Sparrow's Point reported that it was operating at much less than 50 percent of capacity because of inability to keep labor in the vicinity. Reports of similar tenor came from the Harlan & Hollingsworth and Pusey & Jones plants, and prediction was made from the Newport News yard that ship deliveries could be speeded up as much as six to eight months were adequate housing arrangements available to shelter a full complement of ship workers convenient to the scene of operations.

Lack of houses has been specifically blamed by some of the shipbuilders for the high "mortality" of labor, which has reached appalling proportions during the past year. The Bethlehem Steel Company reported that its yard could produce one and one-half ships per month additional if they had the operatives, but that workmen could not be held under conditions which necessitated residence in Baltimore with a trip of, say, an hour and a half duration each way, every day. The consequence was that this corporation had a labor turnover of approximately 11,000 men in eight months in order to maintain a force of 4,000 operatives. In reality, the record was even more discouraging than the above figures would indicate, because the company, in its effort to permanently increase its force, employed some 18,000 men, of which number about 11,000 were actually put to work, remaining on the job, at an average, for only a comparatively brief interval.

In the gratification in most quarters over the fact that the Emergency Fleet Corporation has definitely undertaken relief work in shipyard housing, there is no disposition to ignore or underestimate what various private shipbuilders have done in an attempt to solve the problem. Meyer Bloomfield, assistant to Manager Flannery, remarked on this score: "The shipbuilders have spent an enormous amount of time personally on these problems. Some of them have engaged men specially for the purpose of hunting up houses, negotiating rentals and making arrangements for houses; and in many instances those efforts came to naught."

Generous Co-operation of Private Shipbuilders

During the discussions of arrangements for housing some of the private shipbuilding interests have offered to contribute to a housing fund that would be made up mainly by governmental appropriation. For example, the Bath Iron Works, which requires 100 houses for skilled workers and 25 houses for salaried men, involving a total expenditure of $450,000 (£92,200), indicated at one time that it might be willing to contribute 10 percent. A tentative proposal from the Newport News Ship Building Company contemplated the donation of sites for 700 houses to cost $2,500 to $3,000 (£513 to £615) each. Various concerns have at one time or another put forward proposals looking to the payment of interest on a Government loan for housing purposes. In some instances guarantees for the ultimate return of the Government loan or a large part of it were contemplated, and in other cases no such assurance was forthcoming.

In the case of Government-owned shipyards, operating under agency contracts, the fact that the Government owns the housing of the machinery is taken as sufficient justification for governmental construction of housing for labor. This explains why it is possible to push with especial energy the housing operations at plants such as Hog Island, where it is expected that independent dwellings will have to be provided for approximately 12,000 men, allowing for the housing of 14,000 to 15,000 workers in Philadelphia and the accommodation of a maximum of 3,000 men in barracks or dormitories at Hog Island. Of course, there remains for adjustment in the case of Government-erected houses at Government-owned plants, just as with dwellings at private shipyards, the arrangements as to mortgages with reference to ship workers

who desire to purchase the properties they occupy. Such details have not been fully worked out, or, if worked out, are subject to revision, but the feeling seems to be that it will be necessary, in order to keep ship workers satisfied, to put on a blanket mortgage or to introduce the instrumentality of stock sales, so that no shipyard employee will hesitate to buy a home for fear of being tied to any company or any community by reason of ownership of a house that could not be easily sold.

Dwelling Construction at Hog Island

The ideas that have been entertained in official quarters with respect to housing arrangements at shipyards are perhaps best indicated by a brief resumé of the recommendations with respect to dwelling construction at Hog Island. The first recommendation was for two types of houses to be built in varying numbers. The first type was a semi-permanent frame, one-story cottage type in one-, two- and four-family units, to be built without cellar, equipped for stove heat, complete bath and kitchen plumbing, wall-board partitions and generally light construction. The second type house was similar to the design just mentioned, but provided with a partial cellar and furnace heat, and was available in a two-story as well as single-story design. A rental charge based upon 10 percent of the gross cost of the buildings and public utilities was suggested.

Pending a permanent disposition of the housing problem at Hog Island, a considerable part of the force has been housed in temporary barracks of the dormitory type —eight rooms to the barracks, each room with accommodations for 12 men. For these accommodations a uniform charge of 10 cents (0/5) per night is made. Gradually, sentiment with respect to the housing of shipyard workers seems to be crystallizing in favor of the standardized four-, five- and six-room houses, with no room smaller than 10 by 12 feet in size, such houses to cost, at a rough estimate, anywhere from $2,000 to $3,500 (£410 to £717), each according to local conditions, etc.

In working out the housing proposition, every attention is to be bestowed upon the experience of private shipbuilders, who have in the past acted in this matter on their own initiative. "Model houses" for shipyard workers, such as have been provided by the McDougal Duluth Shipbuilding Company and other concerns, are expected to afford ideas for the dwellings that will be sponsored by the Emergency Fleet Corporation.

New Type of Construction for Wooden Steamer Designed by Lee & Brinton, of Seattle

AT the yard of the Allen Shipbuilding Company, at Ballard, the keel has been recently laid for a wooden steamer of a special type of construction, to be built for the Emergency Fleet Corporation. The general arrangement of the vessel will be the same as that of the Ferris design, and the same propelling machinery will be used, although the vessel is slightly larger than the Ferris ship, with a length over all of 288 feet, molded beam 43 feet 8 inches, and molded depth 26 feet 4 inches, and having a deadweight carrying capacity of 3,650 tons.

Plans for the new vessel are being drawn by Lee & Brinton, naval architects, of Seattle, who are introducing a type of construction which they have heretofore used with success in small craft, and in which they are now adapting for use in vessels of the larger sizes.

The peculiarities of the construction consist in the method of building the frames, which are of the single-frame construction, as compared with the double-frame method ordinarily used in wooden shipbuilding. For the parallel mid-body, which is carried 45 percent of the length of the vessel, each set of frames is made up of only three pieces, consisting of a deep floor timber running in one piece from side to side of the vessel and connected to the two side timbers by a special method of bilge construction. The floor timber runs flat on top, and the dead rise is sawed out of the lower side. The turn of the bilge has a radius of 4 feet 6 inches, and the midship section approximates that of a steel steamer of the same size. Forward and aft the parallel mid-body the floor timbers start to rise and are cut at the centerline of the ship, while the side frames are slanted in towards the centerline and with the radius of the bilge gradually increasing so that a fair shipshape form of under-body is produced.

The advantages of this type of construction for rapid building are quite apparent, and it is claimed by the architects that the construction is stronger than the ordinary type. The plans have been approved and recommended by the surveyors for the American Bureau of Shipping, Lloyd's register, and the naval architects for the Shipping Board. The contract calls for delivery of the hull in six months' time.

Effect of Torpedo Explosions on the Structure of Merchant Ships

SOME time ago the Council of the Institution of Naval Architects appointed a committee "to inquire into the effects of explosions of mines and torpedoes on the structure of merchant ships." The committee was constituted as follows: S. W. Barnaby (chairman), Admiral Sir Henry Jackson, G.C.B., F.R.S.; *Professor Sir John Biles, D.Sc., LL.D.; W. H. Whiting, C.B.; A. E. Seaton, Professor T. B. Abell, M. Eng.; Professor J. J. Welch, M.Sc.; R. W. Dana, M.A., secretary.

Their first report is on cargo steamers, and the second on passenger steamers, and they were submitted in May, 1917. They were made available privately to shipbuilders and shipowners; but official sanction was given to their publication along with the annual report of the Council to this year's meeting of the institution. The report is as follows:

I.—Cargo Ships

Your committee have thought it desirable to issue a preliminary report containing suggestions for certain temporary war expedients which might be adopted at very little expense in the ordinary type of cargo vessel, and which they are of opinion would have the effect of greatly increasing their chances of safety after being mined or torpedoed, provided that only one main compartment is opened up to the sea.

The committee, having examined the information placed at their disposal by the Admiralty and the Board of Trade, are of opinion that the loss of many of these vessels has been due to three causes: (a) the existence of watertight doors low down in the bulkheads, which could not be closed after the explosion; (b) fractures of suction pipes in the attacked compartment, permitting water to flow into adjacent compartments; (c) the penetration of bulkheads adjacent to the attacked compartments by fragments of plating, frames, rivets, etc.

A large number of cargo vessels have four main holds and six bulkheads arranged as follows: No. 1, collision

*Sir John Biles has been absent owing to illness since the first meeting of the committee.

bulkhead; No. 2, between Nos. 1 and 2 holds; No. 3, at fore end of boiler room; No. 4, at aft end of engine room; No. 5, between Nos. 3 and 4 holds; No. 6, at after peak.

With fewer bulkheads than this the chances of keeping a vessel afloat are very much reduced.

Taking this six bulkhead arrangement as a typical case, the recommendations of the committee, as applied to cargo ships with six or more bulkheads, are as follows:

1. All existing watertight doors low down in main bulkheads should be closed up and so secured that they cannot be opened. If watertight doors are necessary, they should be fitted high up in the bulkhead.

This is particularly important when bunker coal is carried forward of the boiler room bulkhead, as a watertight door through which coal is being trimmed cannot be depended upon.

2. The watertight door to the shaft tunnel in the engine room bulkhead should be closed up and so secured that it cannot be opened, access to the tunnel being provided by means of a watertight trunk carried up to the bulkhead deck.

Cases have occurred when the engine room has been flooded too quickly to permit of the tunnel door being closed, with the result that considerable quantities of water have entered the after holds through the tunnel, which was not sufficiently watertight.

An explosion in one of the after holds would be likely to injure the tunnel, resulting in the flooding of the engine room and boiler room, unless the tunnel door is closed, as proposed.

3. The tunnel, or any other longitudinal passage below the waterline, should be thoroughly watertight.

4. Each suction pipe, where it enters the compartment from which it drains, should be provided with a screw-down non-return or other suitable valve, which can be worked from the bulkhead deck. These valves should be kept closed at all times, except when the pumps are in use.

5. The amount of injury which the bulkheads might receive from flying fragments will depend greatly on the nature and amount of cargo in the hold.

If the hold is well filled, the risk of injury is much less than when partly filled or empty. If the cargo is of a heavy nature the upper parts of the bulkheads will probably be exposed.

It is recommended that, wherever possible, the bulkheads should be protected temporarily by means of timber or other suitable material, forming a splinter screen. In some cases the cargo itself could be utilized for this purpose. The necessity for some protection of this sort is particularly great in the case of ships in ballast.

Very little time and money would be expended in giving these measures of protection to a large number of cargo vessels.

II.—Existing Large Mail and Passenger Vessels

These vessels, having more numerous bulkheads in proportion to their length than the ordinary cargo steamer already reported on, should be better able to withstand attack from mine or torpedo.

On the other hand, many mail and passenger steamers have watertight doors in the 'tween decks, giving communication through the watertight bulkheads between passenger and other spaces. They have also side scuttles for ventilating cabins, and numerous sanitary discharges very near the waterline. These are liable to be submerged and to admit water should the scuttles be open or the controlling valves to the baths, water closets, etc., be inefficient. This liability will be greater in the case of vessels having small initial stability or possessing longitudinal bulkheads, if damage occurs in way of such bulkheads. In some vessels also there are passages leading through bulkheads in the ship's hold to allow the firemen and greasers to gain their quarters without traversing any of the passenger decks. All these features have proved to be sources of danger.

Further, the hatchways in such vessels are relatively small and do not afford such instantaneous relief from air and gas pressure resulting from an explosion as in the case of the larger hatchways of cargo vessels. For this reason it is considered that bulkheads in the neighborhood of the explosion are more liable to distortion in mail and passenger vessels than in cargo ships, and that watertight doors on such bulkheads cannot be relied upon to close after an explosion. Devices for closing doors from the bridge are likely to fail, both by reason of the above-mentioned distortion and because of the probable destruction of the hydraulic or electric mains provided for the purpose in the region of the explosion.

In view of the foregoing, it is suggested that the following measures be adopted in existing vessels during the continuance of the war:

1. The disuse of all firemen's passages and the closing up of all doorways in bulkheads traversed by them when below the bulkhead deck, the firemen passing to and from their quarters by way of an upper deck, where a temporary screened passage could be provided if necessary.

2. All openings from the engine room into shaft tunnels to be abolished and access to tunnels provided through trunks abaft the engine room bulkhead: these trunks to be watertight to the bulkhead deck.

3. All watertight doors in transverse bulkheads throughout the machinery spaces to be closed and so secured that they cannot be opened, provision being made for efficient supervision in each separate compartment. If this is deemed impracticable in certain cases it is recommended that in such cases the doors on the level of the stokehold and engine room floors should be closed and others fitted as high up as possible on these bulkheads.

4. All watertight doors in transverse bulkheads on decks below the bulkhead deck to be closed and so secured that they cannot be opened, additional exits to the decks above being provided where necessary.

5. All side scuttles situated below the first deck above the bulkhead deck should be closed up and sealed. Special fan ventilation is to be provided if necessary for the cabins affected.

6. Each suction pipe, where it enters the compartment from which it drains, should be provided with a screw-down non-return or other suitable valve which can be worked from the bulkhead deck. These valves are to be kept closed except when the pumps are in use.

7. Where ventilation trunks, etc., pass through watertight bulkheads below the bulkhead deck, valves operated from above that deck should, in all cases, be fitted at the bulkheads, and if any trunk pierces the bulkhead at a low level it is strongly recommended that a new lead should be devised to carry it through the bulkhead at as high a level as possible.

8. Valves on all sanitary discharges at the ship's side should be such as will prevent water passing inboard through them when the vessel has considerable trim or list. These valves should be frequently examined and kept in good order.

9. Any ash or rubbish shoots, etc., having upper ends opening on decks below the bulkhead deck should be provided with watertight covers, and instructions should be issued to ensure that these covers are always in place when the shoots are not in use.

Build More Wooden Ships

**Plea for Continuation of Wooden Shipbuilding—
Foreign Countries Ready to Order Wooden Ships**

BY H. J. ROUNDY*

A RECENT resumé of shipbuilding in the United States for the year 1917, as published in a paper devoted, in part, to marine construction, contains the following remarkable statement:

"There followed the proposal to build a large number of wooden steamships in new yards constructed for the purpose. It did not meet with the approval of practical ship men.——," and later continues: "There was never any adequate reason for the wooden ship, because the labor and the material to make them were not available."

The above statements are quite erroneous and are misleading to both technical and non-technical people. The American public, from ideas obtained from newspaper articles of similar caliber to those above noted, are beginning to believe that our gigantic wooden shipbuilding programme has failed, and that immense amounts of money have been wasted in attempting to further this programme. To show that it is possible to avoid a useless expenditure of money in the outlay of these shipyards and consequent loss to the United States Government of just so much money, which is needed for the prosecution of the war, it is the intention of this article to attempt to rehabilitate the wooden shipbuilding programme in the minds of the people who are doubting and condemning.

It is not the intention of the article to claim that steel ships are inferior to wooden ships, or *vice versa,* or to show that wooden ships can even approximate the economy or efficiency of steel-hulled vessels. But it is the idea to show that wooden vessels have a fixed and certain place in the shipbuilding programme of the United States, and that it would be folly to rule the continuation of the construction of wooden vessels out of existence.

Practicability of Wooden Shipbuilding

Let us first discuss practicability, and at the start take into consideration the size of the majority of wooden ships we are at present building and compare them with some of their predecessors. The idea of impracticability seems to arise, in part, from the false notion that we are building ships far too large for wooden vessels, and that these wooden vessels, after being built, are short-lived. Let us reconsider some of the big wooden vessels of olden times.

First, there was the *Arabia,* of the Cunard Line, which was 285 feet long; the *Adriatic,* of the Collins Line, which was 351 feet long, and which, by the way, saw 42 years of service. Then there was the *Vanderbilt,* 331 feet long. This vessel was built in 1855, and in 1910 was still afloat at Gibraltar. The *Ontario,* which was 325 feet long, 43 feet beam, 29 feet depth, and which was the largest wooden screw steamer ever built, only ended her career when she was broken up at the age of 30 years in Boston. The size of the ships we are building range from 280 to 315 feet long, which is not excessive when compared to some of those above mentioned. There is no reason why some of our wooden ships will not last for 30 years, as well as our old-time ships, provided due care is used in their construction and in the selection of the timber. Even should they last but six months, they would surely pay for themselves, and the rankest kind of timber should keep from decay that long.

What Wooden Ships Have Done

We must remember that practically all the territory we now know of has been discovered with the aid of wooden ships; that a great proportion of the commerce of the world has been transported with wooden ships; that a great many wooden ships still are being used in transatlantic and coastwise trade. Because steel ships have supplanted wooden vessels almost entirely for transatlantic trade at present is no reason why wooden vessels should not supplement steel ships in transatlantic trade at the present time. Even though it be considered unwise to send these wooden vessels across the ocean, they would still have a very great field in performing the duties of coastwise steamers, thus releasing numbers of small steel vessels for foreign trade.

A noticeable trait of the American people is to decry any innovation. Wooden shipbuilding, as described and condemned in newspapers, magazines, congressional speeches, etc., is such an innovation. The American public are convinced that they are being deluded by false hopes of the ultimate success of the wooden ship. To offset this idea, let me state that the company with which the writer is at present connected has received numerous requests for plans, specifications, contracts, etc., from Norwegian, English, Italian and French owners. Were it not for Government stipulations, which forbid shipyards taking additional contracts while they are working on vessels for the Emergency Fleet Corporation, all the yards on the Gulf Coast would be overloaded with contracts for ships to be built for these foreign countries. This shows that countries that have had large merchant marines are not skeptical about buying wooden vessels.

It may be also stated that in one yard on the Gulf Coast two immense wooden steamers are being built for a line none other than the conservative Cunard Line. This yard could get contracts for a dozen more had they not turned over their plant for United States Government use. At another yard in the vicinity there are ten or twelve large wooden vessels being built for the Italian government. These countries realize the advantages of wooden ships. America apparently does not. We are building both steel and wooden ships, it is true, but while new contracts are almost daily being given out for steel bottoms, no attempt is made to give additional contracts for wooden vessels. After the war immense numbers of wooden ships will be built for foreign nations and the United States will get none. Foreign countries will be willing to build up their disorganized shipping with any kind of vessels, while the United States will be sticking exclusively to steel.

Ships, and More Ships, Wanted

Let us now discuss the "adequate reason" mentioned in the article above referred to. Curiously, it is answered later by this trite statement: "Ships, More Ships, and Still More Ships." Ships, we are told by the rulers of our nation, are as necessary as soldiers in winning this war. This statement would seem to be a reason for using

*General Superintendent, Universal Shipbuilding Company, Houston, Texas.

anything that we can get on earth that would carry cargo or for using anything that we can get that will make something else that will carry cargo. We need the ships and we should be reasonable and use whatever it is possible to get that will serve our purpose. Let us draw a simile:

Suppose it were necessary immediately to construct two bridges across the East River in order that thousands of people on Long Island might be saved from some dire catastrophe. Suppose, also, there were only steel and steel workers enough to construct one bridge, and that there were wood and wood workers enough to construct the other bridge. What would you do? Would you condemn the wooden bridge, saying that it was impracticable, obsolete, would probably rot in twenty years? Would you also say: "No; let us wait until we get the additional steel and men to work the steel, which will be in six or eight months, as a few thousand lives more or less do not matter, but we surely ought not to allow our engineering progressiveness to be degraded"? No. The answer would be to build bridges out of any material, even straw, if we could get it to last long enough to relieve the situation in hand; but, at any rate, build bridges!

Utility and Economy of Wooden Ships

There are some points relative to the building of these wooden ships which newspapers and technical papers devoted fanatically to pure engineering subjects do not often discuss, viz.: the utility and economy. As to their utility, they can go anywhere that the steel ship can, and they have gone places where steel ships cannot and do not go. They can trade in the warm waters of the Gulf and the Mediterranean, or in the North Atlantic, as efficiently as steel vessels; and they can trade in the ice fields of the North where steel ships do not often go. Efficiency, in the case of the present war, is not merely dependent upon the amount of food and ammunition that can be stowed in one hull and sent across the Atlantic, but is really dependent only on the amount of food and munitions we can get across the ocean in a certain time. The amount of freight carried in a wooden ship of the same displacement as a steel ship is undoubtedly smaller; but there is no reason why enough wooden ships cannot be built to overbalance this difference. For the same amount of freight carried, the more ships we use, provided they are completely loaded, the less risk there is in their being molested on their passage. Hence, smaller ships mean smaller risks, smaller crews and no increase of cost.

In discussing the constructive economy, there are three features to be considered: First, relative cost; second, conservation of labor; and third, speed of construction.

Relative Cost

Taking first the relative cost, let us draw a few comparisons. In the following tabulations remember that the figures refer to deadweight tonnage, which is a principal factor in determining ship economy. The following figures comprise averages of all the steamships building in the United States at the end of December, 1917:

Type	Average Deadweight Tons	Average Cost Per Deadweight Ton
Composite	3,568	$133.97 (£27.56)
Steel	7,027	166.48 (£34.25)
Wood	3,752	139.69 (£28.74)

The above figures are for ships complete with engines and boilers. The United States Shipping Board is paying builders for the Ferris type vessel only, approximately $84.87 (£17.46) per deadweight ton. It will thus be seen that while the cost per ton of composite ships is the lowest, the entirely wooden ship is much lower than the entirely steel ship, the cost of a wooden ship per deadweight ton being nearly seventeen percent less than a steel ship per deadweight ton.

Conservation of Labor

Second, regarding conservation of labor. These new wood ships which are mentioned so disparagingly have taken practically no men from steel yards, leaving all these men to continue their work for the Government on steel ships. To stop the construction of wooden vessels would not increase the number of men in the steel yards by the addition of these wood workers, as these men are entirely unused to steel shipbuilding tools. The steel shipbuilding industry gets many recruits from boiler makers, steel bridge men and steel construction men. Wooden shipbuilding gets its recruits from house carpenters, timbermen and wooden bridge builders. There is a sharp, definite line drawn between the two classes of men, and releasing one from duty would not amplify the ranks of the other.

Speed of Construction

Third, let us consider the speed of construction. The following data have been taken from the statements of Chairman Hurley, of the United States Shipping Board, to the investigating Senate committee:

At the beginning of the year there were being constructed in the United States the following general classes of ships of the tonnage denoted:

Wooden ships	1,344,900 tons
Composite ships	207,000 tons
Steel ships	3,965,200 tons

This shows that 24 percent of the total tonnage of ships under construction was made up of the entirely wooden ships.

Reverting once more to the paragraph mentioning the new wooden yards, we have from Chairman Hurley a statement that this tonnage was being constructed in 72 wooden yards, 51 of which had been organized just for these contracts, and in 32 steel yards, 20 of which, also, were brand new. This indicates that 70.8 percent of the wooden shipyards were brand new, which would indicate that they should be further behind in their progress. Offsetting this, we have his statement that at the beginning of January the steel tonnage was 4 percent completed; composite tonnage, 20 percent and wood tonnage, 9 percent towards completion, showing that, despite the fact that ship carpenters were practically unobtainable and lumber was scarce, the wooden vessels were over twice as far towards completion as the steel ships. This much for the speed of construction.

Conclusions

We know how necessary it is that we have ships, ships of any class—wood, composite, concrete or steel. The above figures show that wooden ships in first cost are cheaper than steel, and are being constructed faster than steel, and that in their building we are dragging no one away from the construction of steel vessels. The obvious result would be to build more wooden ships.

Cries of conservation of timber are used in the effort to combat the wooden shipbuilding programme; but consider conservation in its true meaning. If we care to, we could take an accurate count of every board foot of timber on earth, but we cannot do the same with iron and steel. We do not know when steel or iron will give out, but we can figure when we will use up all of our timber. Should the Government so desire, it might foster tree farming as an agricultural science. There is no reason why we should ever be out of timber, provided it is used judiciously. Iron will, without a doubt, oxidize, and is lost forever, and we can make no new to compensate for its

loss. Timber should be conserved, but so should every other animal, vegetable or mineral which is valuable to mankind. It is not absolutely necessary to make ships out of the material specified by the United States Shipping Board. Columbus used no long-leaf yellow pine or Douglas fir. We are using in the construction of our wooden ships materials that twenty years ago were not ordinarily thought of for shipbuilding purposes, viz.: Red gum, Bois D'arc, etc. We are plentifully supplied with sweet gum, which could very easily take the place of yellow pine.

And there is another way of conserving timber, and that is to so design our vessels that the immense pieces of timber we are now using are not necessary. One way of overcoming this trouble is to use diagonal planking. This not only reduces the size of the timbers, but obviates the use of steel strapping, another commodity which is in great demand at present. We might also have a more efficient disposal of strength members in the ships by placing them where they will be of some use, rather than where they will take up room. We can also cut down the cost of our wooden vessels and add to their carrying capacity by placing engines aft; use less ornate furnishings in the accommodations, remembering that space in a freightship is the primary object, and not separate rooms for every man in the crew. The last way of cheapening the construction of wooden ships is to build them where the materials can be readily had, viz.: in the South and on the West Coast.

The Ship of the Future

Let us look at the ship of the future. Will she be wood, composite, concrete or steel? Undoubtedly, she will be steel or concrete, but it is not the ship of the future we are now worried about; what we are concerned with is the ship of the present. Why not use any material that will construct any object that will carry freight or troops across the ocean? Why not use the material that will build ships cheaper, faster and as serviceable, viz., wood? Our wooden shipyards in the United States will finish their contracts in September. Are these yards to keep going and continue to build ships for the United States, or will they just build ships for our English, French, Italian and Norwegian neighbors? Immense sums have been layed out in these yards. Why not give the United States the opportunity to increase its merchant marine tonnage by means of these yards? Why not keep going on with our old-new industry and build more wooden ships, at least until the war is won and American commerce is once more in the van?

First Motorship Fitted with Reduction Gears

The 3,500-ton motorship *James Timpson,* built by the G. M. Standifer Construction Corporation, Portland, Ore., is fitted with two 500-horsepower Winton Diesel engines equipped with reduction gears designed to give the vessel a speed of about eight miles an hour. The engines are of the six-cylinder type, designed to run at a normal speed of 325 revolutions a minute, while, by means of the reduction gears, the propellers turn at 100 revolutions per minute.

The vessel was built to the order of I. T. Williams & Son, New York, and is intended for the mahogany trade out of New York. She is 279 feet long, 44 feet molded beam and 25 feet molded depth.

An engineer who answered the question "What is a vacuum?" in an examination for a first-class certificate by "A vacuum is foul air which generally comes from the bilge," had run engines for sixteen years with great success, and no one could beat him in scraping a valve or keeping his engine in first-class shape.

How Local Business Organizations Can Help in Transportation of Shipyard Workers

ANSWERING the question "What can the local business organizations do in helping provide adequate transportation for the shipworkers," Philip H. Gadsden, president of the Charleston Light and Power Company, one of the members of the National Committee on Public Utility Conditions, of the Chamber of Commerce of the United States, at its recent convention called for co-operation on the part of the public for the street car companies, a willingness to put up with inconveniences, less frequent service, so that men, effort, fuel, time and material be available for the special service of the Government.

In part, Mr. Gadsden said: "Everything possible should be done to accomplish a more even distribution of traffic and consequent improvement of service. To bring this about, some definite steps should be taken, and I would set forth my suggestions and recommendations in the following order:

"First—Deal with the street car problem in a spirit of co-operation and helpfulness. This includes consideration of an increase in the price of the commodity which the company produces and sells, viz., transportation.

"Second—That the street railways which are not provided with sufficient equipment and other facilities to properly handle present and prospective traffic make every effort to secure such equipment and facilities as far as will be practicable at the earliest possible date.

"Third—That the street railways put into effect everything that can be done to bring about improved efficiency and the conservation of materials and man power.

"Fourth—That the attention of the officials of industrial and governmental plants be attracted to the necessity of full co-operation by staggering the hours of employees so that the same number of cars and men can be used for several trips, instead of only one.

"Fifth—Attention of members of department stores and other commercial establishments should be called to this matter, in the hope that they will adopt such means as may be most efficient in their efforts to induce their patrons to co-operate in the movement to secure a more even distribution of traffic by advocating that women do their shopping in the morning and early hours of the afternoon. That the newspapers of the State shall join in the movement in order that the greatest publicity may be obtained.

"Sixth—That the hearty co-operation of the authorities in the various municipalities in the State be given to the movement; that the Boards of Trade and Chambers of Commerce give their assistance to accomplish the results sought.

"Seventh—That the skip-stop method of operation be adopted.

"Eighth—That the communities forego during the period of the war new pavements or repavements and other improvements which would require expenditures by the street railway company.

"From an extensive and intimate acquaintance with men engaged in the street car industry, I know I can promise their hearty co-operation in everything that will tend toward the upbuilding of the communities they serve, and their best and most loyal efforts to the strengthening of our country's arm in its present hour of need."

NEW PACIFIC COAST STEAM SCHOONERS

Designed by D. W. and R. Z. Dickie, San Francisco, Cal.

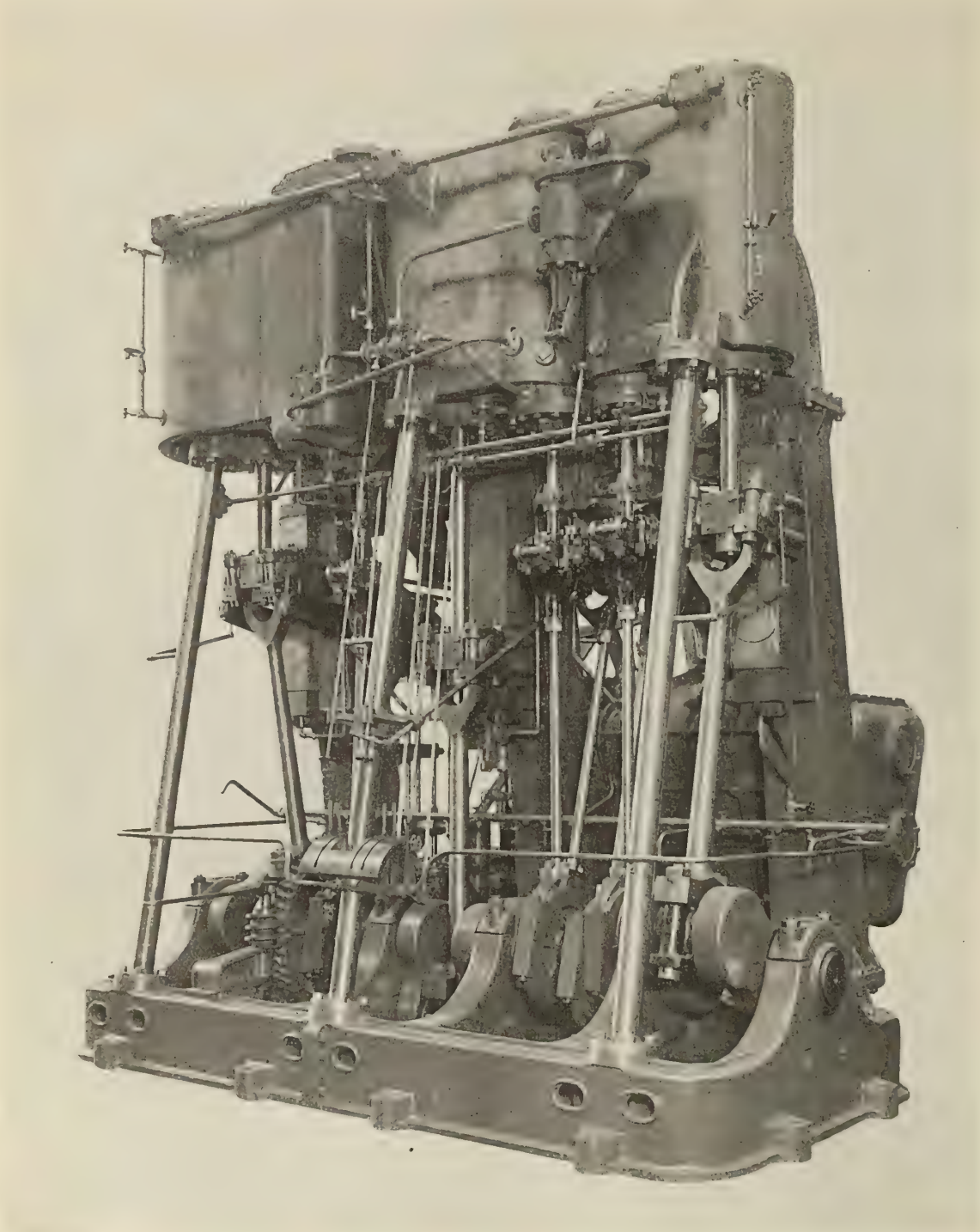


Fig. 1.—Triple Expansion Engine, Designed and Built by Main Street Iron Works, San Francisco, Cal.

Fig. 2.—S. S. *Edna Christenson*

Fig. 3.—S. S. *Lucinda Hanify*

New Pacific Coast Steam Schooners

Wooden Lumber Carriers Designed by D. W. and R. Z. Dickie, Naval Architects, San Francisco, Cal.

TWO sister ships—the *Edna Christenson* and *Lucinda Hanify,* in which are embodied some of the latest developments in wooden lumber-carrying steam-schooner design, have recently been completed and subsequently sold to the French government.

These steamers are duplicates and the hulls were built to the order of Sudden & Christenson and the J. R. Hanify Company, under a labor contract with Charles Fulton, of Long Beach, Cal., and to plans by D. W. & R. Z. Dickie, of San Francisco, the design being worked up from the ideas of Mr. E. A. Christenson, president of the Sudden & Christenson Company, and the work done under the direct

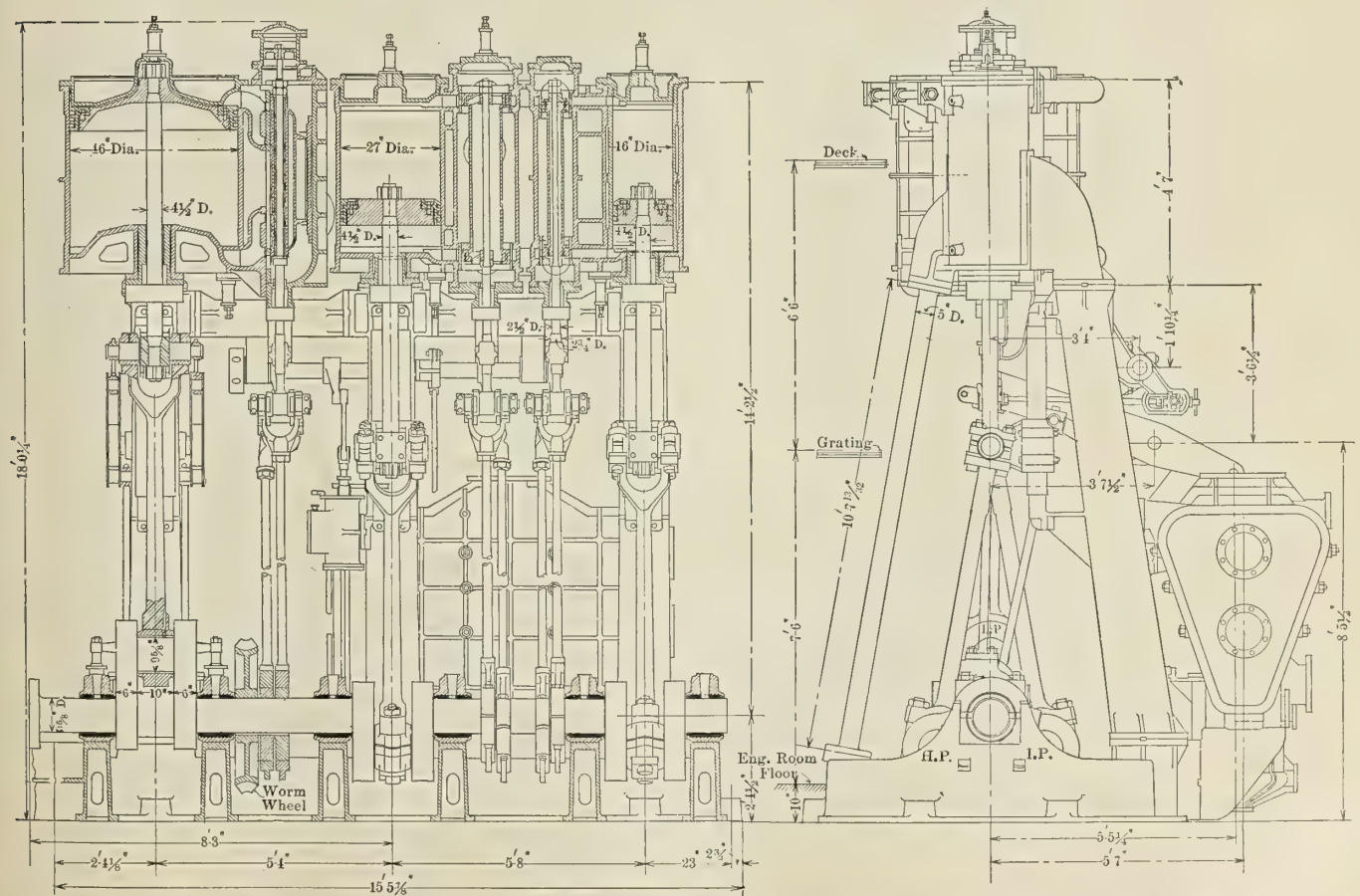


Fig. 4.—Main Engines—Cylinders, 16, 27 and 46 Inches Diameter; Stroke, 33 Inches; Revolutions per Minute, 110

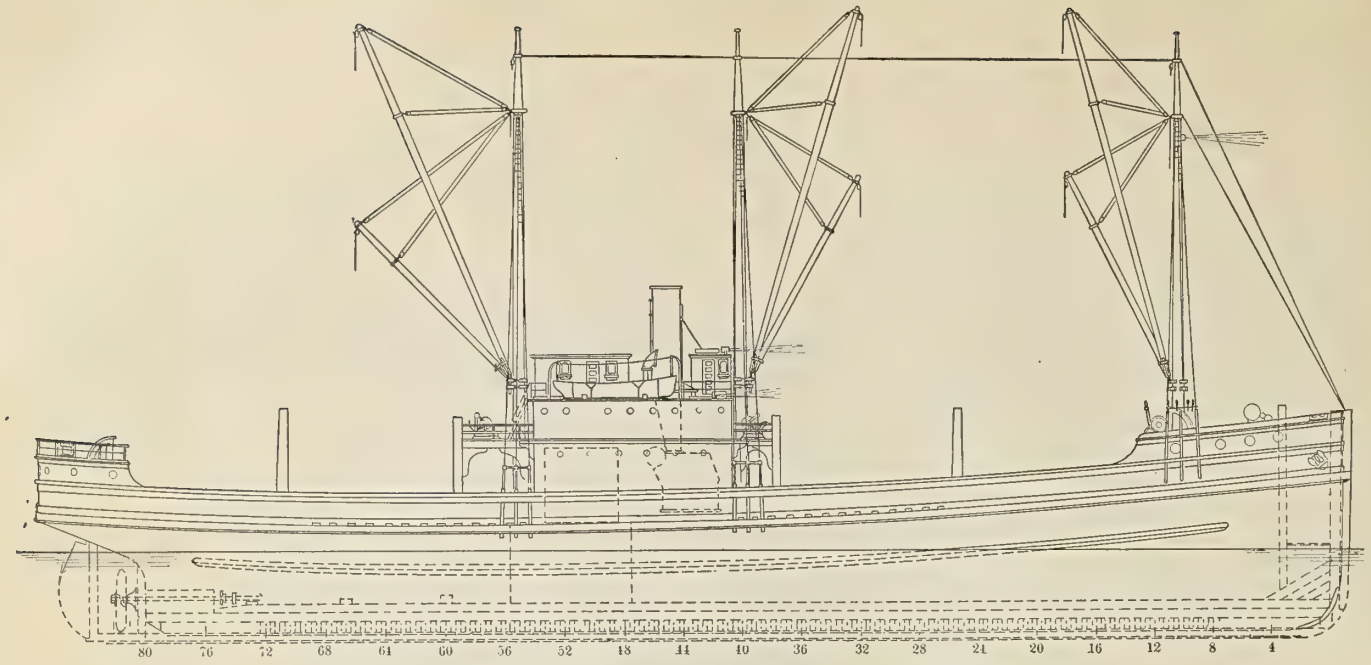


Fig. 5.—Outboard Profile

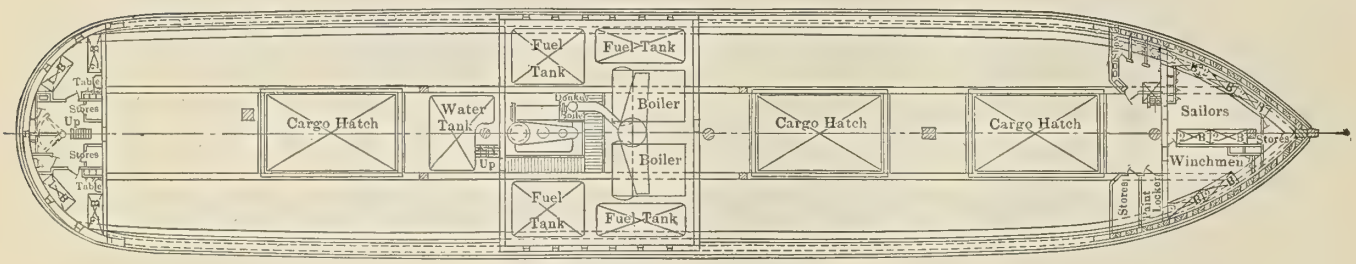


Fig. 6.—Plan of Main Deck

supervision of Captain Johnson and James Pendergast.

The principal dimensions of the two craft are: length over all, 235 feet; length from after side of rudder post to rabbet of stem at load waterline, 225 feet; extreme beam, 44 feet; depth of hold from top of 12-inch ceiling next to sister assistant keels onto the under side of deck planking, 17 feet; gross measurement, 1,497 tons; net register, 1,105 tons.

As shown by the general plans, Fig. 8, these vessels are single screw, with straight stem and elliptical stern and fitted with three masts, which handle the cargo gear. Double booms are fitted on each mast as shown, in order to facilitate the loading and discharging of lumber or other cargo.

The full width of the deck is carried as far fore and aft as possible to permit of the deck load being stowed in as long lengths as possible; and the after body lines will show that the buttocks are kept as straight as possible and the waterlines fairly full in order to give good lumber stowage in the after hold and at the same time keep the vessel rather fine aft in order that she might handle well.

The general arrangements of the vessel have practically been decided by the position of the cargo gear, which is so placed as to give an equal amount of lumber for each rig to handle.

The original owners found that it has always been more expensive to handle lumber which is stowed alongside of the machinery space, and for this reason shortened up the house as much as possible and built it to the full width of the ship.

Boilers Placed on the Main Deck

It will also be noted that the boilers have been placed on the main deck, instead of the hold, as is usual. This arrangement gives a little more cargo space and does away with the necessity of building a light and vent trunk.

This arrangement allows of inside doors for all rooms in the crew accommodations, a feature which will be appreciated on the Pacific Coast, where the strong summer winds make this arrangement advisable.

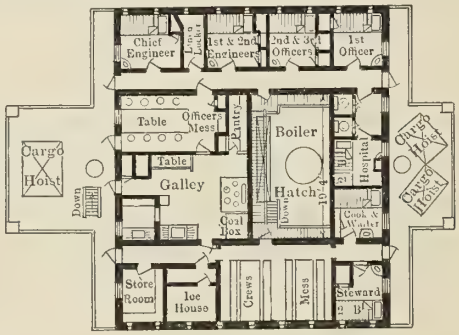


Fig. 7.—Accommodation Plan of Upper Deck

The fuel oil tanks are placed alongside of the engine, both in the hold and on deck, and it will be noticed that the arrangement is very compact.

The officers' accommodations are all in the midship house and very comfortably arranged. As many comforts have been provided here as possible, the vessels being

NEW PACIFIC COAST STEAM SCHOONERS

Designed by D. W. and R. Z. Dickie, Naval Architects, San Francisco, Cal.

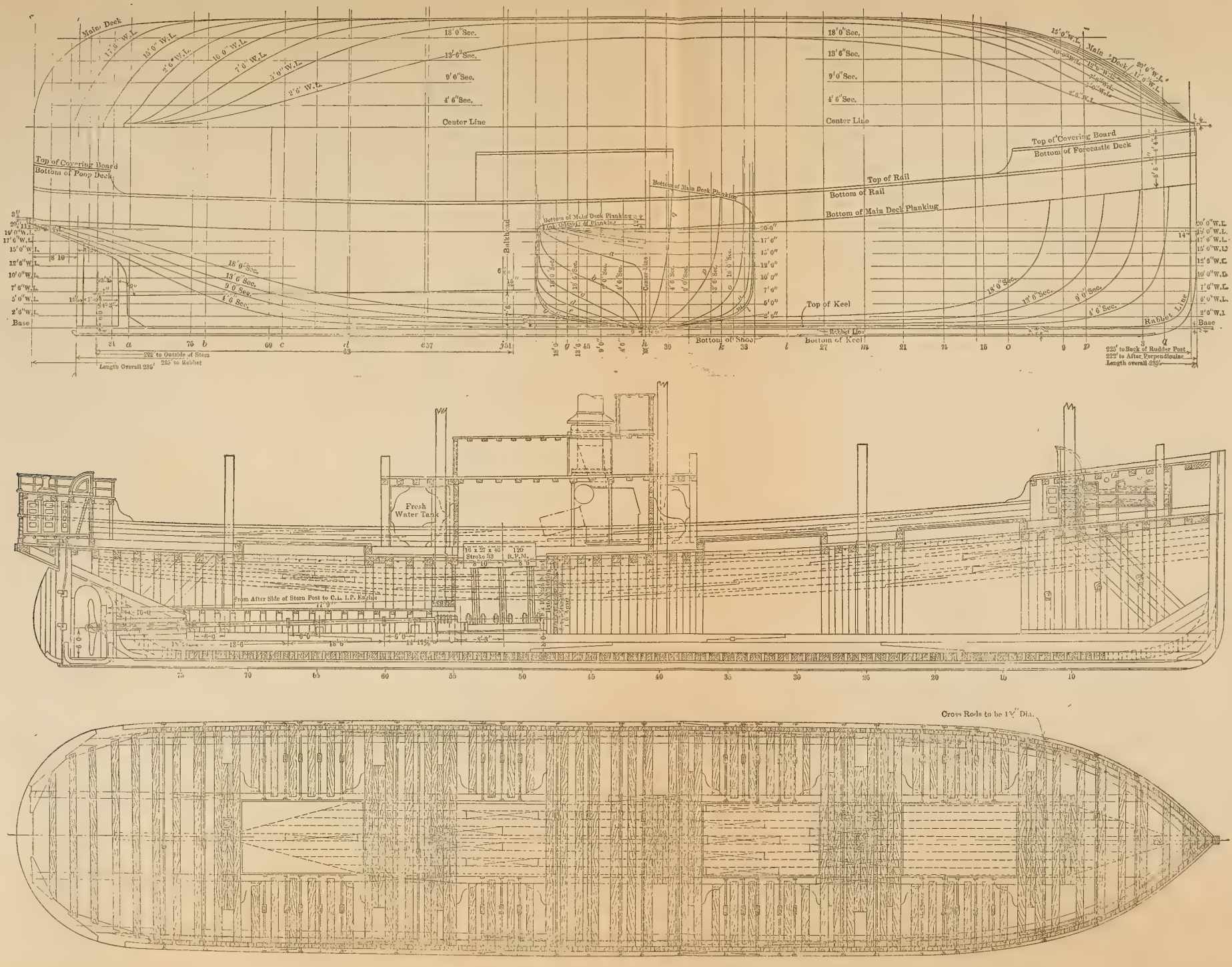


Fig. 8.—Displacement Lines to Outside of Planking and Construction Plans

intended for long, off-shore voyages whenever the occasion arises for their use in such trades.

On the hurricane deck there is a pilot house, which has been made 16 feet wide, in order to accommodate the officer on watch, as well as the man at the wheel; and the captain's stateroom, office and bath, which occupies a house 16 feet square. On the Pacific Coast in late years it has been the custom to build a shelter house on the bridge for the officers and watch, owing to the cold winds in the summer and the rains on the northern runs in the winter months. In these vessels the two have been combined, the pilot house being in reality a large shelter cabin similar to that which has been adopted on British steamers.

In the forecastle accommodations have been arranged for the crew, including showers, wash rooms and toilets, while the poop contains accommodations for the petty officers.

Hull Construction

Douglas fir was used almost entirely in the hull construction, with black iron fastenings in the hold and galvanized iron fastenings where exposed to the weather.

The keel is of Douglas fir in three lengths, sided and molded 18 inches and with 14-foot scarphs. The keel is fitted with a 3-inch pine shoe. The stem and stern posts are of oak, kneed as shown on the plans. The rudder post is of ironbark with an 18-inch rudderstock, also of ironbark, backed with pine and fitted with three sets of composition braces. The stuffing box is on deck. The deadwood is of pine, molded to take the heel of the cant frames.

The frames are of pine, sided 12 inches and spaced 32 inches centers, and in the wake of the house they are carried up to the upper deck. The ceiling is 12 inches thick and 16 inches wide on the back. The clamps are 14 inches by 16 inches; the deck beams are 16 inches by 16 inches, with a knee under every beam; the waterways are 16 by 16 inches and 14 by 14 inches; the deck is of 6-inch by 6-inch pine, and the planking 4 inches, with garboards 8 inches and 6 inches.

In the wake of the midship house one side of the frames is carried up to the floor of the upper deck.

The main keelson is of pine, sided 18 inches and molded 24 inches, in three lengths, with rider keelsons 18 by 18 and eight sister keelsons sided 18 and molded 24 inches. The main ceiling is worked out of 12 by 16-inch pine.

The clamps are 14 by 16 inches and average 60-foot lengths, keyed with 4-inch oak keys in the scarphs. The deck beams are of 16 by 16-inch pine spaced 2 feet 10 inches and crowned 7 inches, except in the wake of the hatches, where they are 24 inches apart, with a knee under each beam.

There are two hooks on deck forward and two sets aft, besides three pointers of 14 by 14-inch pine with 10 by 18-inch stanchions, with an iron bar cap on the top.

Between the pointers forward 16 by 16-inch panting beams are fitted. The hatch ledges are continuous from stem to stern, stopping at the intersection of the waterway. Alongside of the cargo hatches and engine hatches tie-rods are fitted, as shown on the plans, of 1¼-inch diameter and turnbuckles between. The deck is of 6 by 6-inch pine, long lengths as possible, and the bulwarks are 5 feet high and built as shown on amidship section.

The garboard strake is 8 by 16-inch, and the second garboard is 6 by 16 inches, while the remainder of the planking is 4 inches thick, except the wales, which are 6 by 8 inches, except one 10 by 12-inch strake to carry the lower fender. The shaft log is of pine, made in two pieces 18 by 36 inches, with white cedar stern timbers. The Sampson posts are 24 by 24 inches at the deck, tapered to 18 by 24 inches at the top. The fenders are 10 by 15-inch pine capped with 4 by 12-inch ironbark.

The arrangement of the forecastle deck house and poop

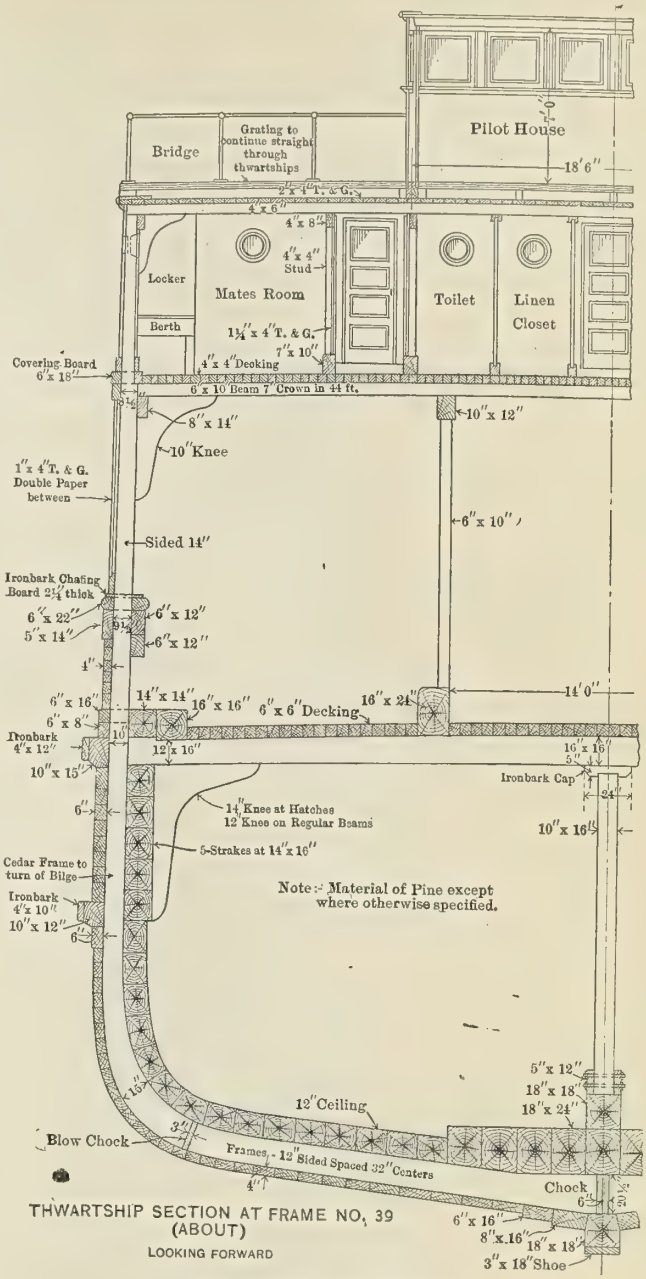


Fig. 9.—Midship Section

are shown on the plans, and it will be noticed that there is a winch deck just forward and aft of the midship house to keep the cargo winches clear of the deck load.

Propelling Machinery

The vessels are fitted with Ward watertube boilers having a combined heating surface of 4,000 square feet and 52 square feet of grate area, furnishing steam at 225 pounds pressure. The owners have the idea in mind that should the vessel be on a run where coal was cheaper than oil, to have sufficient heating surface to steam easily with coal. The engines are triple expansion, with cylinders 16, 27 and 46 inches in diameter with 33-inch stroke operating at 110 revolutions.

These engines were designed and built by the Main Street Iron Works, of San Francisco. The high and in-

termediate cylinders are fitted with piston valves; the low with a double-ported slide valve.

The principal aim in the design of these engines has been—

First—To economize on space, and therefore all valve gear has been placed on the inside.

Second—Economy in operation.

In this respect the clearances in each end of the cylinders have been reduced to a minimum by shortening up the length of the ports.

The engines are of the standard triple-expansion design, with this exception, that they are fitted with a cast iron box type of guide, which is a departure from the usual and accepted standard.

The surface condenser is of the Weir four-flow type, having a length of tube of 6 feet, with a surface of about 50 percent less than as usually designed. It is cast separate and is bolted to the high and intermediate columns. The air pump is of the Edwards type. The water enters at the bottom, with the outlet at the top.

The thrust bearing is of the horseshoe type, and is fitted with water circulation in the collars. There are two feed and two bilge pumps worked from the low pressure crosshead.

These engines have proved remarkably economical in fuel consumption, due to the cylinder ratio and number of expansions. They were built for a guaranteed output of 1,000 indicated horsepower, having in view, however, that this would be only at economical cruising speed, with the cut-off run in on the high and intermediate cylinders so as to get a high number of expansions. They will develop 1,250 indicated horsepower at an economical speed. On the trial trips the engines showed practically no vibration.

The low pressure piston is of cast steel, made as light as possible, and is counterbalanced by the weight of the air, feed and bilge pumps, while the intermediate pressure piston is cast solid, as well as the high. This was done to minimize as much as possible the unbalanced weights of the pistons, which set up vibration.

The electric light plant is a General Electric 10-kilowatt, direct connected set; the ice plant a one-half-ton Brunswick machine; the steam steering gear is of the standard Dake type. The cargo winches are of the 8-inch by 12-inch Filer & Stowell oscillating type, with a single drum, two to each mast. A new feature on these boats is a warping engine designed under the supervision of Mr. James Pendergast, the marine superintendent of the Sudden & Christenson Company. This warping engine has steam cylinders 7 inches by 10 inches double, geared 13 to 1 to the gypsies.

All the auxiliary machinery in the engine room is in separate units, the vessels having independent line, bilge and other pumps.

On a trial trip on San Francisco Bay, with a draft of 7 feet forward and 14 feet 6 inches aft, these vessels made a speed of 12.09 knots, the boiler pressure being 225 pounds, first receiver 85 pounds, second receiver 10 pounds, and a vacuum of 25½ inches, turning a propeller 11 feet 6 inches in diameter, 12 feet pitch and 40 percent surface at 115 revolutions per minute.

Loaded with 1,400,000 feet of spruce and with a draft forward of 18 feet and a draft aft of 20 feet 6 inches they showed a sustained speed at sea on a 72-hour voyage of 11.2 knots, on a fuel consumption of 82 barrels of fuel oil per day, the engines developing about 1,150 horsepower. On this trip the deck load was 18 feet high forward and 12 feet high aft, the condition of the bar where she was loaded preventing the vessel from being loaded to draw more than 20 feet 6 inches. On a draft of 21 feet 6 inches she will carry slightly over one million and a half feet of lumber.

Boats for the New York Barge Canal

THE annual report of the New York State Engineer and Surveyor has the following to say with reference to the lack of vessels for navigating the New York Barge Canal:

During the past year much has been said in the public press as to the lack of boats suitable for use on the new canal. It is true that such a condition exists. There are practically no boats of a type suited for efficient operation on the new system, and few, if any, are in course of construction. When the canal was planned it was assumed that the boats to operate in its channel would be provided by private capital, and such was the logical conclusion to draw. The war, however, has entirely changed this aspect of the situation, and without definite assurances from the Federal Government that it will co-operate, it seems very doubtful if capital can be attracted to this field until peace returns. This is not surprising, inasmuch as capital cannot now be induced to take up any new transportation scheme unless the Government renders assistance. The unfortunate condition exists, however, that if a decision to help is not speedily arrived at, this splendid canal will not be permitted to play its part as a war resource this coming navigation season, not because it will not be open for navigation, but because there will be practically no equipment to float upon it.

In assuming control of the railroads, the Government becomes supreme in matters of transportation. It can dictate the nature of shipments and the routes to be followed. The first assistance, then, on the part of the Government to be given private capital interested in the construction of canal barges should include assurance of freight to carry. In view of the railroad situation, this ought to be simple. Anyone who is at all conversant with the subject knows that the cost of shipping by water is less than by rail, and to those who have given the subject deeper study, the popular conception of the slow-moving barge as compared to the "fast freight" is known to be erroneous. Tonnage has for years slowly, but surely, been diverted from the canals of New York State to the railroads. It is not necessary to review the reasons for this, but the canal advocate believes such to be the case, and an examination of the records of the departments presided over by the officials charged with canal matters appears to verify the contention.

Reasonable time of delivery on materials entering into the construction of barges is for the greater part subject to priority orders. Assurances should be forthcoming from the Government as to the certainty of receiving promptly these materials, and once the barges are placed in commission the owners and operators should feel that they are not to be commandeered for use in other waters.

The boat situation as related to our canals is a serious one. The State, after constructing the canal which connects the Atlantic seaboard with the Great Lakes, should not be expected to build the barges. Millions of tons of freight pass through the State. The canal in 1918 can carry 10,000,000 tons between Lakes and tidewater and thus release thousands of freight cars for use in sections of the country where inland water transportation has not been developed to the extent it has in New York State. To win the war it has been stated that the United States must build boats, boats and more boats. The result which could be accomplished by placing a limited number in commission on the Barge Canal is self-evident.

Concrete Barges and Ships*

Comparison with Steel and Wooden Vessels—Strength, Elasticity and Cost—Tentative Designs

THE idea of building ships or other floating vessels of reinforced concrete is not new. For many years and in several different countries attempts have been made from time to time to build small boats and barges of reinforced concrete. From the information at hand, apparently some of these attempts have been successful and the vessels thus built have been in use for considerable periods. However, no definite information regarding boats built prior to the war is at hand which would assist in solving the general problem of the concrete ship.

Since the beginning of the war, however, owing to the loss of the world's tonnage due to submarine sinkings, the attention of many naval architects, concrete engineers and others has been drawn to the question of concrete ships to replace those sunk. The scarcity of steel, wood and labor, and the length of time necessary to construct ships of steel or wood direct attention generally to the substitution of reinforced concrete. Norway appears to have taken the lead in this work, and two different companies are already building ships of concrete. The Porsgrund Cement Works, whose vice-president and general manager, Mr. Jens Hauland, has recently been in this country, has already launched one or more ships of 100 tons cargo capacity and is reported to have under construction a ship of 1,000 tons cargo capacity. The general design of these ships follows generally that of a framed steel ship. According to Mr. Hauland, the weight compares very favorably with that of a steel ship. No definite information is available, however, by which this statement can be verified.

The Fougner Steel Concrete Shipbuilding Company, of Christiania, Norway, has been building vessels since June, 1916. About eighteen in all have been launched up to the present time. Several others are under construction. The *Namsenfjord,* about 400 tons displacement, launched some time ago, has made a round trip between Norway and England. No detailed information is available at the present time regarding these vessels that would throw light on the general problem.

On this side of the Atlantic, at least two ships are under construction. At San Francisco a large ship about 5,000 tons capacity is being built. This ship is 320 feet long, 44 feet 6 inches beam and 30 feet deep. At 24 feet draft the displacement is said to be 8,000 tons. The weight of the hull is said to be 2,200 tons. At Montreal, Canada, a small concrete ship which will have about 300 tons carrying capacity has already been launched and is now being equipped. This vessel is being constructed by the Atlas Construction Company, Limited, of which Mr. Chas. M. Morssen is president. This ship is 126 feet long between perpendiculars, 22 feet 6 inches beam, with a depth of 12 feet 6 inches. The displacement is about 650 tons. The ship will be self-propelled, and is now being equipped with boilers and engines. She will shortly make her first trip. No estimate of cost is at present available.

With the exception of the two ships noted above, little information has been gained from the ships now under construction which will assist in the solution of the concrete ship problem.

The present report will confine itself to a general statement of the several elements which make up the concrete ship problem and a discussion of the information obtained from the tentative design of a concrete ship.

In order to make any advance toward the solution of the concrete ship problem, information must be obtained concerning several points regarding which only meager information is now available. These points taken together constitute the concrete ship problem.

Relation Between Carrying Capacity and Displacement

It is apparent that the efficiency of a ship as a cargo carrier depends upon the relationship between deadweight and displacement. Expressed in terms of percent, in the average cargo ship built of steel, the deadweight is from 70 to 75 percent of the displacement—taking into account as weight of ship all spars, fittings, deck houses, anchors and chains, auxiliary engines and tanks, but not boilers, engines or coal. In a wooden ship, the deadweight is from 60 to 65 percent of the displacement. It is quite evident that from the difference in weight of materials it will be difficult to design a ship of concrete that will give a relationship between deadweight and displacement approaching that of steel. However, if ships are to be built of concrete for commercial use, the weight of the ship must be such as to provide a reasonable deadweight or cargo capacity for the displacement.

Transverse Strength

The stresses in the transverse members of a ship are in still water functions of the draft and the stiffness, and may be computed by mathematical processes, although the computations are long and laborious. When the material is reinforced concrete the problem becomes much more complicated. Experience has shown, however, that numerous elements other than draft affect the transverse strength of a ship, such as the effect of rolling in a seaway, impact with docks or other ships, and stresses incident to going into dry-dock. The transverse members of cargo ships of to-day are, therefore, not designed to withstand computed stresses, but are designed in accordance with various rules which embody the result of long experience in the construction and use of ships. It should be noted in this connection that granting of insurance depends on compliance with these rules.

Steel ships are of two different types—(a) framed ships, in which transverse frames are spaced from 18 to 24 inches on centers, the plating being riveted to these frames without intermediate longitudinal members, excepting in the bottom; and (b) longitudinally framed ships (Isherwood), in which heavy frames are spaced from 10 to 15 feet on centers, with intermediate longitudinals to which the plating is riveted.

From a comparison with the ordinary steel ship design it would not appear to be difficult to design transverse members of reinforced concrete of equivalent strength to steel members—the question of strength only being considered.

Longitudinal Strength

In a steel ship the entire cross-sectional area of the midship section acts to resist the alternate tensile and compressive stresses, taking into account, in determining

* Report of the joint committee of the American Concrete Institute and Portland Cement Association on concrete barges and ships, November 27, 1917.

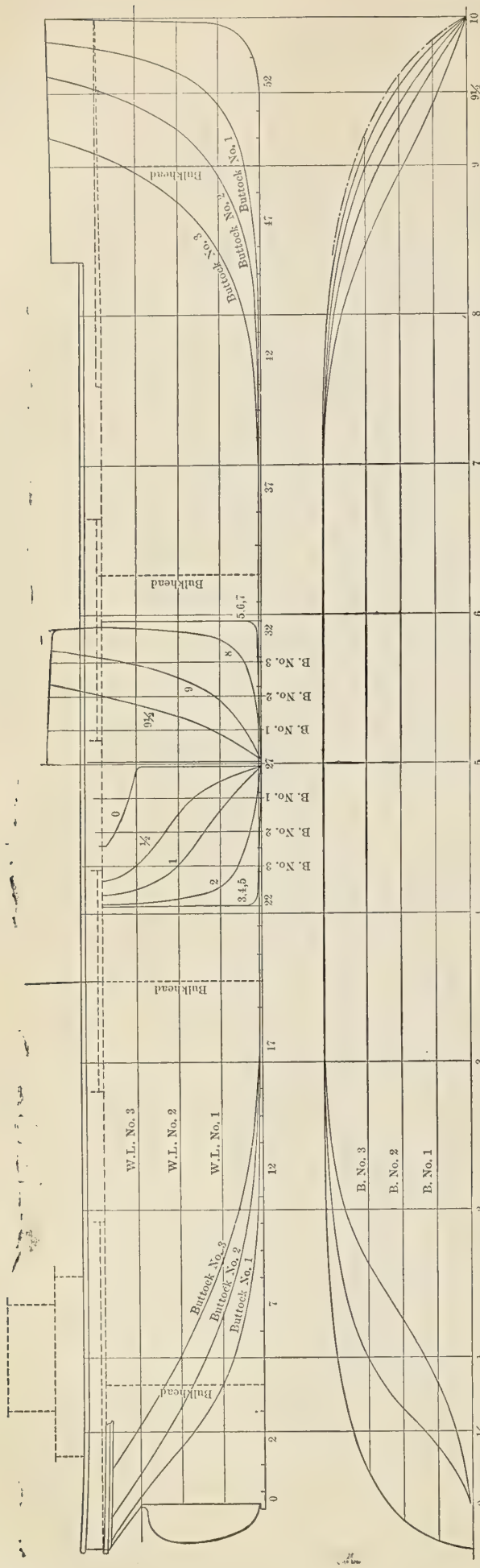


Fig. 1.—Lines of Reinforced Concrete Barge, 227 Feet 6 Inches Long Overall; 42 Feet Beam and 23 Feet Depth; Displacement at 18-Foot Draft, 3,650 Tons; Block Coefficient, 0.77

the moment of inertia, all of the continuous members, such as continuous scantlings and deck, side and bottom plates. In the concrete ship, equivalent strength must be provided. In the case of the concrete ship, however, only the steel reinforcement can be relied upon to take tensile stresses. The concrete, assisted by the steel, will take the compressive stresses.

The effect of the rapid change of the character of the stress in either the deck or the bottom is much more serious in the case of concrete ship than in the steel ship, for the reason that, owing to the low tensile stress of concrete, cracks will occur at the extreme fiber under relatively low tensile stresses in the steel. These cracks, if any, alternately opening and closing, may tend to cause disintegration, with resulting leaks or impairment of the reinforcement.

At the present time little information is available as to the effect of such reversal of stress, and but little can be hoped for until an actual trial has been made of a concrete ship in a sea.

Elasticity

There is an almost unanimous opinion among naval architects and seafaring men generally that a concrete ship will be so inelastic that she will tear herself to pieces in a sea. While it is doubtless true that in a concrete ship there will not be the same readjustment of stresses as in a steel ship when subject to the action of a heavy sea, experience with reinforced concrete structures generally has shown that such structures have considerable elasticity, and there is ample reason for the hope that reinforced concrete will prove a suitable material for shipbuilding purposes.

Effects of Sea Water on Concrete and Reinforced Steel

Until very recently, little information has been available as to the effect of sea water on concrete. The recent work of the Bureau of Standards, acting in co-operation with the Portland Cement Association, has thrown considerable light on what may be expected from the action of sea water. The result of their investigation tends to show that inferior concrete or concrete of which the surface skin has been impaired suffers serious disintegration when in contact with sea water. Inasmuch as in most instances the structures examined which form the basis of the report of the Bureau of Standards, were built without thought as to the action of sea water (it being assumed that there would be no deleterious action), there is every reason to hope that where the effect of sea water is appreciated, and where steps are taken in the way of selected materials and adequate workmanship, assuring a good mix and a satisfactory surface skin, the concrete will not so deteriorate.

With regard to the effect of sea water on the reinforcing steel, there is some question as to whether a thin layer of concrete can be relied upon to protect the steel from corrosion. To provide a thick protective layer of concrete outside of the reinforcing steel is practically out of the question, owing to the large increase in weight. If the reinforcement, therefore, is to be maintained in perfect condition, the steel must be protected by galvanization and by increasing the efficiency of the protective concrete by means of additional care in materials and workmanship and by a surface coating of a waterproofing character.

Relative Cost

Just at the present time the demand for tonnage is so great that any ship of reasonable capacity that can be used for carrying cargo will prove financially successful.

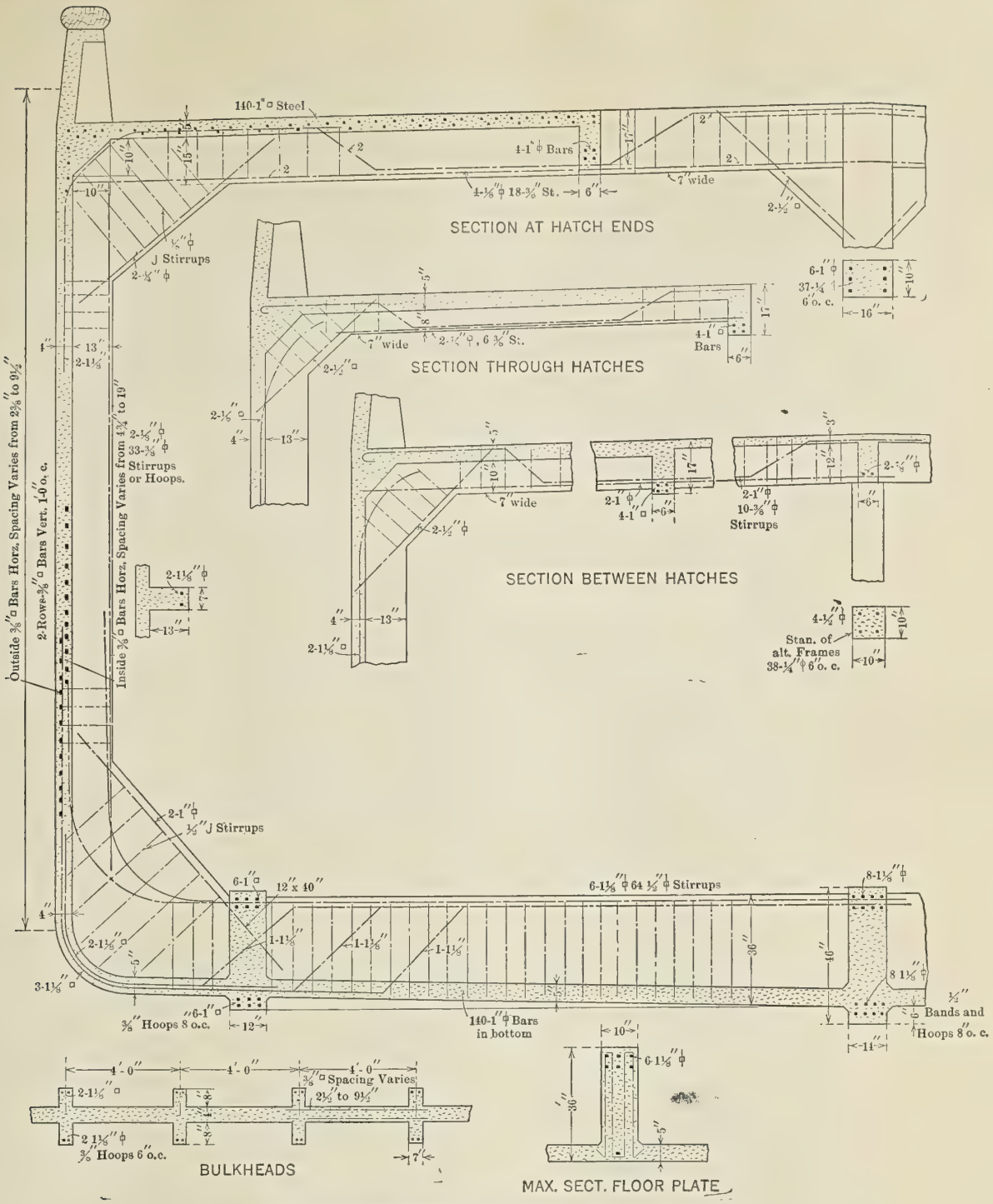


Fig. 2.—Midship Section of Reinforced Concrete Barge

The relative costs of ships of concrete and steel or concrete and wood is not, therefore, as important a consideration as it will be after the war when conditions again approach the normal. However, it is necessary to have an adequate idea of the probable cost of a concrete ship, as well as comparison with the cost of steel and wooden ships.

Speed of Construction

Speed of construction is of vital importance in the shipbuilding programme to-day, owing to the immediate requirements for tonnage. If it shall be found that the concrete ship can be constructed in much less time than a steel or wood ship, this fact will contribute largely to the success of the concrete ship.

Ships devoted to carrying of cargo may be divided for the purpose of this report into two general classes: those adapted to use in still waters, such as harbors, rivers and canals, and those adapted for use at sea, in which provision must be made for wave action.

Tentative Design for a Concrete Barge

Ships for use in still water do not present the same problems of construction as do ships for ocean service. Owing to the need of barges of from 100 to 150 feet in length for use on the canals of New York State, it was the committee's first thought to devote study at this time to the design of a barge which would be suitable for this service. After considerable study and discussion with various naval architects, including the firm of Cox & Stevens, of New York, who were retained by the committee in an advisory capacity, it was deemed advisable to abandon the study of a small still-water barge, for the

reason that while such a study might result in considerable information as to the cost, method of construction and deadweight, compared to displacement, the problem which is of vital importance to solve at this time, namely, whether or not concrete can be adapted for ships necessary for transatlantic and coastwise service, as well as possible service on the Lakes, would remain unsolved, and little or no information would be obtained bearing on this phase of the question. It was, therefore, decided to devote the study to a ship of the seagoing type. In order to simplify the problem as far as possible without omitting any essential elements it was decided to select a barge to be towed rather than a self-propelled ship. This would eliminate all consideration of weight of all boilers and engines, excepting such as would be required for auxiliary hoisting machinery. Because of the fact that so little is known regarding the concrete ship, it was deemed advisable to keep the ship as small as possible. It was thought at first to limit the size to an assumed carrying capacity of 1,000 tons or less.

After many conferences by the committee with its consulting naval architect, it was decided to increase the capacity to about 2,000 tons, it being the decided opinion of the naval architects that a ship smaller than 2,000 tons would have little commercial value after the war, although during the war it would probably prove successful.

In the absence of any reliable data as to the relation between deadweight and displacement for concrete ships, an assumption was made that the deadweight would be approximately 55 percent of the displacement for the proposed tentative barge. Upon this supposition the consulting naval architects laid out the lines for the proposed ship. The dimensions are as follows:

Length (over all)	227 feet 6 inches
Length between perpendiculars	220 feet 0 inches
Beam	42 feet 0 inches
Depth	23 feet 0 inches
Loaded draft	18 feet 0 inches

The hull was given lines such as would provide maximum carrying capacity and still permit reasonable towing and adequate control. At an 18-foot draft the displacement will be about 3,675 tons; at 19-foot draft the displacement will be about 3,860 tons.

The general dimensions of the barge and the lines are indicated in Fig. 1. It should be noted that the midship section of the hull is rectangular, with the exception of a slight crowning of the deck and a slight inclination of the bottom upward toward the bilges (dead rise). The deck is straight throughout and continuous from stem to stern. The ship is divided into five compartments by four transverse bulkheads; the foremost and aftermost compartments are to be used for tanks and ballast, while the three center compartments are for cargo. The cargo compartments are served by three hatches—each about 14 feet by 19 feet.

As has already been noted, the actual stresses in the structural members of a cargo ship are not usually computed, but sections are adopted which long experience has shown to be safe.

After consultation with the naval architects, it was thought desirable to take as a criterion a steel ship designed in accordance with the rules as laid down by Lloyd's and provide equivalent strength in reinforced concrete, with such modifications as the difference in material would make necessary. It was assumed that the concrete for the ship would be poured, as in a concrete building. A limit of 3 inches was placed upon the thickness of the concrete, as that was considered the minimum thickness that can be poured satisfactorily.

The question of weight being vital in the design of a concrete ship, it was deemed desirable to assume a concrete of high crushing and shearing strength. A concrete of one part Portland cement and one part carefully selected sand and two parts selected gravel (about ½ inch) was decided upon, which if properly mixed should give an ultimate crushing strength in excess of 3,000 pounds per square inch. The stress in the concrete in extreme fiber was limited to 1,000 pounds per square inch. In order to reduce the danger of cracking the concrete in extreme fiber, a large percentage of steel was assumed with a resulting low-tensile stress.

For a ship of the same size, Lloyd's rules require that the frames be placed 24 inches on centers. This was deemed too close for economical use of concrete and a spacing of 4 feet was adopted, making the resisting moment of each frame at all points equivalent to twice the resisting moment of one frame in the steel ship. In determining the strength of the frames of the steel ship as fixed by Lloyd's rules, no allowance was made for the effect of the tank top (floor of the hold) or of the bottom plating. Assuming a spacing of frames of 4 feet and a resisting moment equivalent to two frames, under Lloyd's rules, the floor plate or transverse girder supporting the ship's bottom was found to require a concrete girder 36 inches deep and 10 inches wide, including the bottom slab.

To provide for the negative and positive bending moment in the shell, two lines of reinforcement were assumed—one near the outer surface and one near the inner surface. The load being uniform, the positive bending moment at the center between frames will be approximately one-half of the negative bending moment at the frames. Two-thirds of the total amount of steel was therefore provided near the outer surface and one-third near the inner surface. All the bars are straight, it being considered impracticable to bend the bars. From the lower turn of the bilge up to the deck, one size of bar was assumed with variable spacing to meet the required strength at different depths. The thickness of the shell from the upper turn of the bilge to the rail was fixed at 4 inches. To provide adequate strength against "hogging" or "sagging," tension steel to the extent of 140 square inches was provided in both deck and bottom. This steel was considered also as providing reinforcement for local stresses in the bottom, due to hydrostatic pressure, and in the deck, due to load. It was placed in two layers to take up both negative and positive moments, two-thirds being near the outside surface and one-third near the inner surface. Since this steel will be subject to compression as well as tension, the two layers were securely tied together to prevent buckling. To provide adequate protection to the steel and also to provide sufficient area in concrete to take up the compression stresses, the thickness of the bottom up to the upper turn of the bilge was made 5 inches. The deck between the bulwark and the line of the hatch coamings was made 5 inches also. The deck between hatches and within the lines of the hatch coamings was made 3 inches thick. The deck itself not being sufficient to provide sufficient area in concrete, additional area was added at the junction of the deck and the sides, where it would also tend to increase the resistance to horizontal shear, which would be high at that point.

In the bottom three longitudinal members running from bow to stern were provided, one on the centerline and one at each lower turn of the bilge. These longitudinals or "keelsons" give longitudinal stiffness, assist in distributing the load due to dry-docking and provide additional area for hogging and sagging stresses.

The vertical frames in the sides were made 7 inches wide and 17 inches deep, including the shell, and an

equivalent in strength to steel frames, under Lloyd's rules. At the junction between the floor plate and the side frames a heavy gusset is provided to give additional strength at that point. A similar gusset is provided between the frames and the deck beam. This gusset is increased in size at the beams at hatch ends. The deck along the centerline is supported by means of posts at the ends of each hatch and at alternate deck beams between hatches.

The bulkheads consist of 4-inch slab reinforced near both surfaces and stiffened by reinforced ribs 20 inches in depth over all and 7 inches wide, spaced 4 feet on centers.

Estimate of Quantities and Weights

A conservative estimate of quantities required for the proposed barge gives the following:

Concrete	731 cubic yards
Steel	482,000 pounds
Yellow pine timber for floor of hold	30 M feet b. m.
Oak timber for fender and rail	15 M feet b. m.

Taking the weight of concrete at 144 pounds per cubic foot, weight of steel 490 pounds per cubic foot, and weight of wood 48 pounds per cubic foot, and making an allowance of 77 tons for deck machinery, anchors and chains, spars, water tanks and deck houses, the total weight of ship would be 1,647 tons. Taking the displacement of 18 feet draft at 3,675 tons, the carrying capacity or deadweight could be 2,028 tons. Assuming 19 feet draft, the displacement would be 3,860 tons and the deadweight capacity 2,213 tons.

Cost

Assuming sand, stone, cement and reinforcing steel at current prices, the cost of the hull (exclusive of any equipment, such as deck houses, spars, anchors and chains, engines, boilers and tanks) would approximate $118,000 (£24,200). Assuming the construction of ways, which could be used for the construction of five or more ships, the cost of ways per ship would approximate $8,000 (£1,640), making a total cost of the hull (exclusive of equipment), $126,000 (£25,800).

Based on the figures noted above, the cost of the hull per ton of deadweight would approximate $63.00 (13/2/6). Owing to a wide range in costs of steel and wooden ships of the same character, it is somewhat difficult to arrive at anything approaching a definite estimate for steel or wood ships. The best figures available seem to indicate that the cost of steel hull per deadweight ton ranges from $90 (18/15/0) to $120 (25/0/0), while the cost of a wooden hull ranges from $70 (14/11/8) to $100 (20/16/8).

Other Types of Concrete Ships

The designs of various other types of ship in which reinforced concrete has been proposed, either alone or in combination with structural steel, were examined.

In some of these designs cellular sides and bottoms are proposed. Although double sides and bottoms in ships have distinct advantages when the material is concrete, such a design appears out of the question, not only because of the considerable increase in weight, but also because of the added complication to the form work—already a large item in the cost of a concrete ship.

Designs have been proposed in which structural steel members are used as reinforcement. While such members assist somewhat in maintaining the lines of the ship during the construction of the form work, the added advantages can hardly offset the increased cost due to the fabricated steel work, and the inefficient use of the reinforcement.

One design has been proposed in which structural steel members are used to support a shell of reinforced concrete. While the claim is made that a ship can be built of the proposed design with only about one-half the steel used in a steel ship of the same capacity and at much greater speed of construction, the difficulty of making the two materials act together, thus avoiding cracks, makes the design as proposed of doubtful value.

The committee feels that it is not its function at this time to prepare any detailed plans for a concrete vessel. It is manifestly impossible to design a type of vessel that will be applicable to all classes of service. A barge for use on the canals of New York would not be an efficient type for use in harbors or on the Ohio or on the Mississippi.

Vessels heretofore built have demonstrated that the small barge for still-water service can be built and successfully operated. The solution of the larger problem of a concrete ship will include the solution of smaller vessel problem, in which questions of strength are not of the same prominence.

Although there are some questions regarding the concrete ship which can only be answered by actual experiment, the studies which the committee has made point to the commercial success of the concrete ship.

It is suggested that specifications for a concrete vessel should embody the following principles:

1. Both cement and aggregates should be selected with great care to insure a concrete of maximum efficiency.

2. The concrete should be placed in one continuous operation to insure monolithic construction. The concrete mixture should be such as will develop a crushing strength in excess of 3,000 pounds per square inch when tested in standard cylinders at 28 days. A concrete consisting of one part Portland cement, one part sand and two parts ½-inch aggregate may be expected to give such a concrete. The mixture and workmanship in placing must be such as will assure impermeability.

3. The reinforcing steel should be in the form of deformed bars and should be galvanized.

4. In parts of the vessel where cracks in the concrete would tend to cause leaks, the stress in the steel should be kept low (preferably less than 12,000 pounds).

5. Some form of elastic waterproofing coating should be applied to the hull below the deck.

The "Trackless Train" on New York Piers

THE great industries of the country are very much alive to the fact that labor is scarce. They realize that labor will probably be more scarce a few months hence, and many of these industries are fortifying themselves against such shortage by utilizing labor-saving devices (many of which are entirely practical and a means of effecting increases in capacity), relieving congestion and reducing the cost of operation, beside taking the place of men who can then be transferred to other and more urgent tasks.

Among these labor-saving devices, one that stands out prominently is the electric industrial tractor, better known, probably, as the "trackless train." This is simply a self-contained power unit which is used to pull trailer trucks loaded with material of various kinds in manufacturing plants, shipyards, lumber yards, freight stations and on piers and docks.

An interesting example of the unusual practicability of these machines is at Piers 4 and 5, the Pennsylvania freight terminal, in New York, which was one of the

Fig. 1.—Industrial Tractor with Loaded Trailer

Fig. 2.—Tractor Hauling Train of Empty Trucks

most congested railroad freight terminals in the country. Here the installation of the tractors and the "trackless train" method of industrial haulage has almost doubled the capacity of this terminal, and the increased tonnage is now handled with about half as many men as were formerly required.

This remarkable change was brought about by the employment of four small electric industrial tractors and 225 trailer trucks, *rebuilt from the old four-wheeled hand trucks formerly used,* and the utilization of the "trackless train" method of haulage, which is in its essentials the same as that of a railroad, the difference being that this system is not—as is the railroad—restricted to rails, and as a consequence is more flexible, and so more efficient.

Under the old system of hand trucking, 165 men were required to move about 25 carloads of freight across the platforms and into the cars themselves. Now, with the new system in operation, only 100 men are needed to load 40 cars with 440 tons of freight in the same time.

Being convinced of the soundness of the "trackless-

Fig. 3.—Interior of Pier Shed, Showing Nature of Package Freight to Be Handled

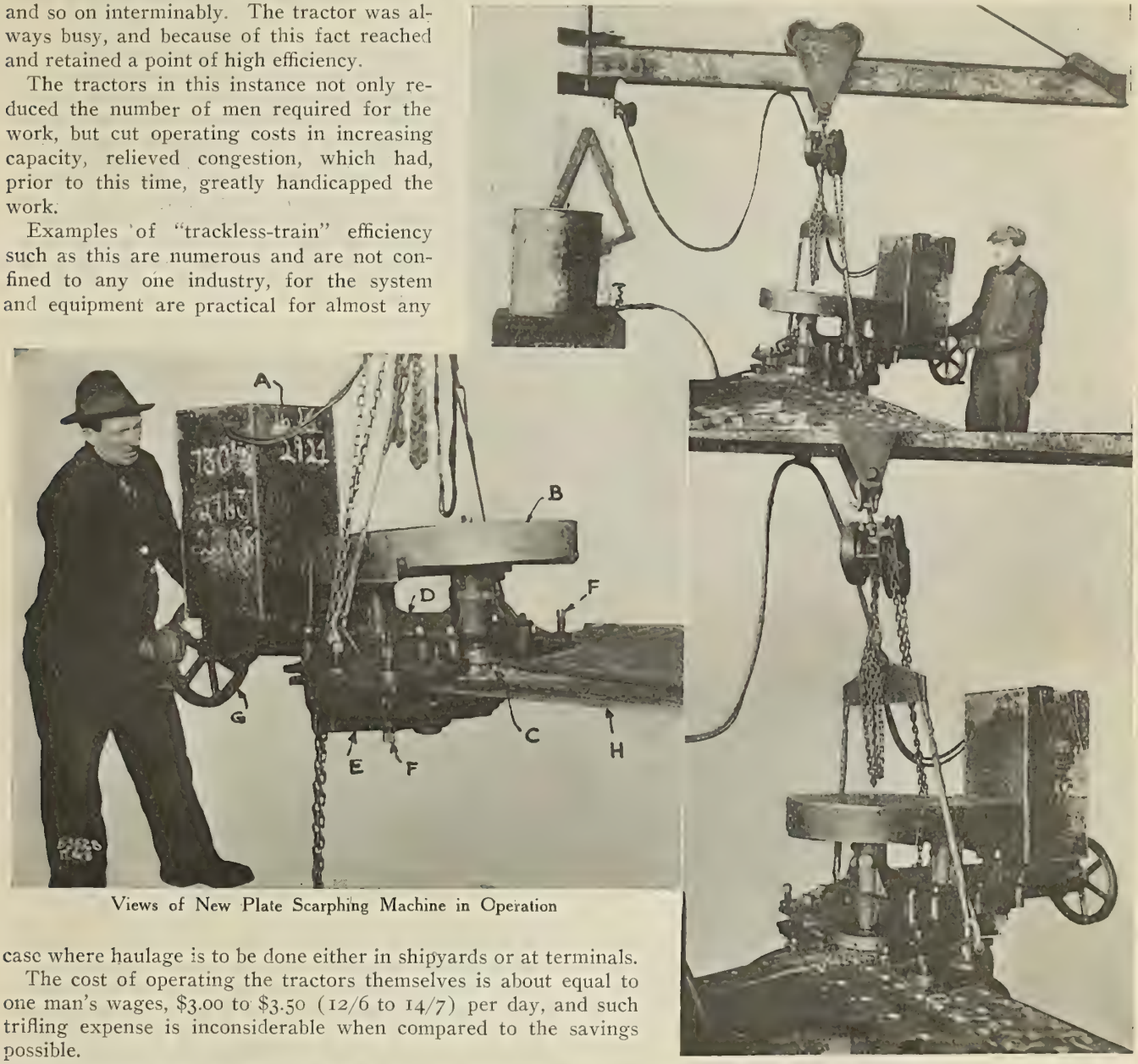
train" method, the officials in charge of these piers laid out the work in conformity with the method, and again the railroad system, in a general way, was used. They realized that to make the tractors most efficient they must be kept busy, so regular schedules were established and retained. Trailers were loaded at the point of origin and prepared for the tractor, which picked them up and deposited them at the destination, returning to the point of origin with empties, which were dropped and a new and loaded train pulled away to its destination, and so on interminably. The tractor was always busy, and because of this fact reached and retained a point of high efficiency.

The tractors in this instance not only reduced the number of men required for the work, but cut operating costs in increasing capacity, relieved congestion, which had, prior to this time, greatly handicapped the work.

Examples of "trackless-train" efficiency such as this are numerous and are not confined to any one industry, for the system and equipment are practical for almost any case where haulage is to be done either in shipyards or at terminals.

The cost of operating the tractors themselves is about equal to one man's wages, $3.00 to $3.50 (12/6 to 14/7) per day, and such trifling expense is inconsiderable when compared to the savings possible.

The tractors used on Piers 4 and 5 are the three-wheel Type Z machines made by the Mercury Manufacturing Company, of Chicago, and are equipped with 30 A 6 Edison cells.



Views of New Plate Scarphing Machine in Operation

Skinner and Eddy Scarphing Machine

HERETOFORE the usual method of scarphing ship plates has been by means of air-driven chipping tools, with which the desired recesses are cut in the plate, a tedious and expensive procedure, resulting in work which is far from being accurate.

The time required for a skilled workman to chip an average scarph in the plating for a ship by this method is about one hour and fifteen minutes. With the scarphing machine illustrated, which has been developed and is manufactured by the Skinner and Eddy Corporation, Seattle, Wash., it is possible to cut a similar scarph in ten to fifteen minutes, or, allowing ten minutes additional for changing and resetting the machine, a complete, clean, accurately machined scarph may be completed every twenty or twenty-five minutes.

Referring to the illustrations, the box *A* contains an electric motor, which, driving through pinions and gears enclosed in the casing *B*, rotates a vertical shaft which carries at its lower end a milling cutter *C*. All the above mechanism is mounted upon a sliding carriage *D*, which is guided in the main frame *E*. This frame is clamped to the work by means of the set screws *F*. These screws permit a considerable range of adjustment, allowing scarphs of varying angles and lengths to be cut in the plate.

In actual practice, the machine is carried by a sling from a small jib crane, the plate being supported on trestles at a convenient height. After securely clamping the jaws of the frame *E* to the work, the cutter is fed into the plate by means

of handwheel *G* mounted on a feed screw working in a nut fixed in the frame *E*. On the completion of the scarph, the carriage is returned to the original position by reversing the direction of the handwheel *G*. The set screws may then be loosened and the machine readjusted in a different position for cutting a new scarph.

The design of the frame is such that a scarph may be cut at any point on the edge of the plate, or at the extreme corner, as shown in the picture, in which case the set screws on one side of the cutter only are used to clamp the frame to the work. The machine is also arranged with a swiveling head which allows scarphs to be cut at an angle with the side of the plate, as is sometimes necessary on shell plating at the ends of a vessel.

New Types of Wooden Ships Building in Texas

TWO new types of wooden ships are being built at Orange, Texas, known as the Daugherty and Piaggio types. An example of the Daugherty type, the *War Mystery,* a wooden steamship of 4,700 tons deadweight carrying capacity, was illustrated and described on page 216 of our April issue. Views of a Piaggio type ship, the *City of Gulfport,* are shown on this and the opposite pages.

The *City of Gulfport,* launched at Orange, Texas, recently took on a cargo at New Orleans for an Italian port. The gross tonnage of the *City of Gulfport* is 1,844 and the net tonnage 1,670. She has a spread of 4,760 square yards of canvas and is equipped with two 100 horsepower Fairbanks-Morse engines. There are electric lights and running water aboard, with bath rooms for the officers and crew.

The commander of the *City of Gulfport* is Captain Norman S. Winskill, twenty-seven years old, said to be the youngest captain on the Atlantic coast. Captain Winskill was formerly first mate on one of the United Fruit steamers.

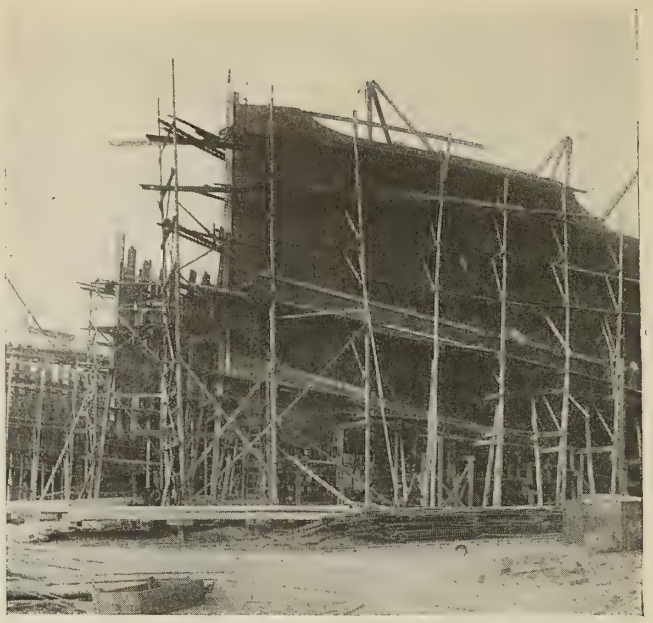


Fig. 2.—Daugherty Type Wooden Steamer Under Construction at Orange, Texas, Showing Diagonal Planking

In design and construction the *Daugherty* type ships differ radically from the Ferris type of wooden ship adopted by the Emergency Fleet Corporation. One of the principal differences is that the *Daugherty* type has a deadweight carrying capacity of 4,700 tons, as compared to 3,500 tons of the Ferris model, yet the larger vessel requires less than 1,500,000 feet of material to construct, as compared to approximately 1,750,000 feet required for the Ferris ship.

Fig. 1.—The *City of Gulfport,* Fourth Piaggio Ship Recently Launched at Orange, Texas

Fig. 3.—The *City of Gulfport* Ready for Her Maiden Voyage

Fig. 4.—View on Deck of *City of Gulfport*

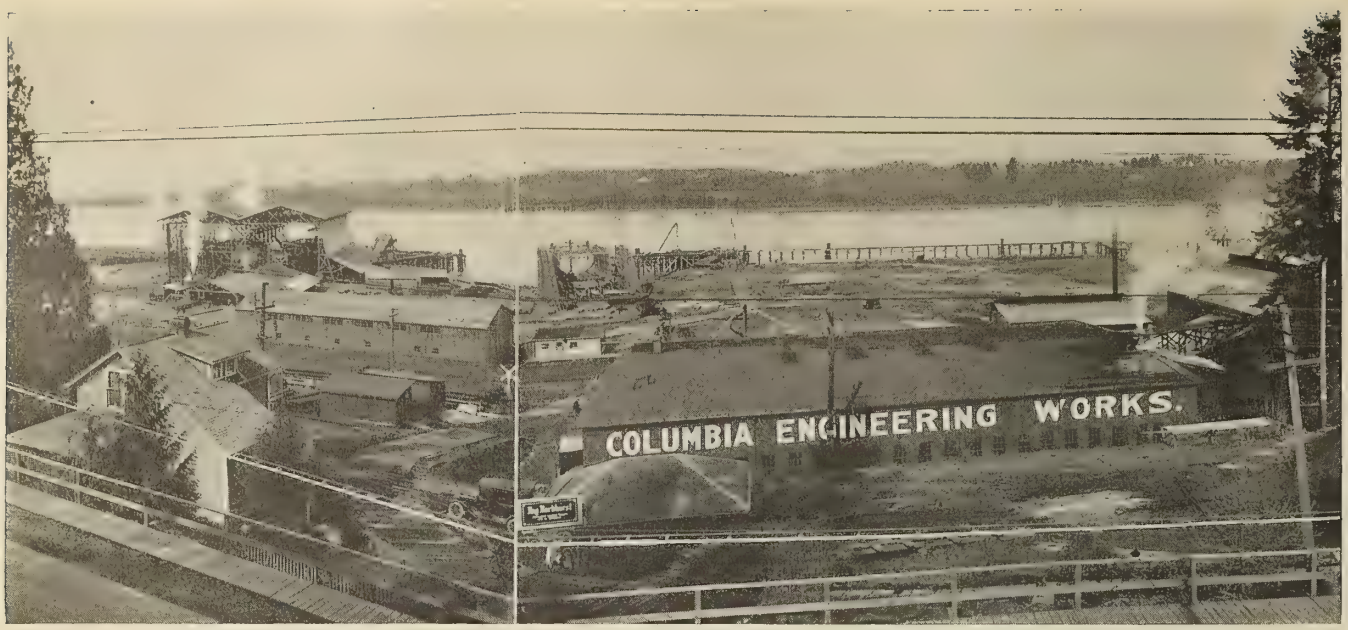


Fig. 1.—General View of Plant of Columbia Engineering Works, Portland, Ore.

Shipyard of Columbia Engineering Works

Fully-Equipped Plant for Building Wooden Ships at Portland, Ore.—Special Features in Design of Vessels Built

DUE to their advantageous location with respect to an unlimited supply of materials, favorable climate and an adequate labor market, shipbuilders and engineers on the northern Pacific Coast quickly took advantage of the extraordinary demand for vessel tonnage two years ago and immediately developed their resources for building ships. Among those manufacturers engaged in other lines of work, which showed their resourcefulness by promptly adapting their facilities to wooden shipbuilding, was the Columbia Engineering Works, Portland, Ore., of which S. M. Mears is president, and A. M. Mears general manager. Since October, 1916, this firm has been operating a fully equipped yard for building wooden vessels on the Willamette River, about five miles from the Columbia and within the city limits of Portland.

This yard has specialized in the construction of moderate size types of wooden sailing vessels, most of which have been equipped with auxiliary power consisting of a twin screw arrangement of the Diesel type marine internal combustion engines. Four vessels built by this firm are in service in the ore trade, two being sister ships 185 feet long, 36 feet beam and 16 feet 8 inches depth. The plant is now so organized that a complete vessel is being delivered every thirty days.

Auxiliary Power Installed

Four of the vessels built by this concern have been equipped with the Craig Diesel type engines, built by the James Craig Engine & Machine Works, Jersey City, N. J., two with Skandia oil engines and one with Wolverine engines. The total power in each vessel is about 400 horsepower, although in one case the engines were designed for 600 horsepower.

The Columbia shipyard covers 17 acres and has a water frontage of 1,000 feet. There are four shipways, two of which are under cover.

Fig. 2.—Launching at the Columbia Shipyard

Fig. 3.—Stern of Vessel Shows Graceful Lines of Hull

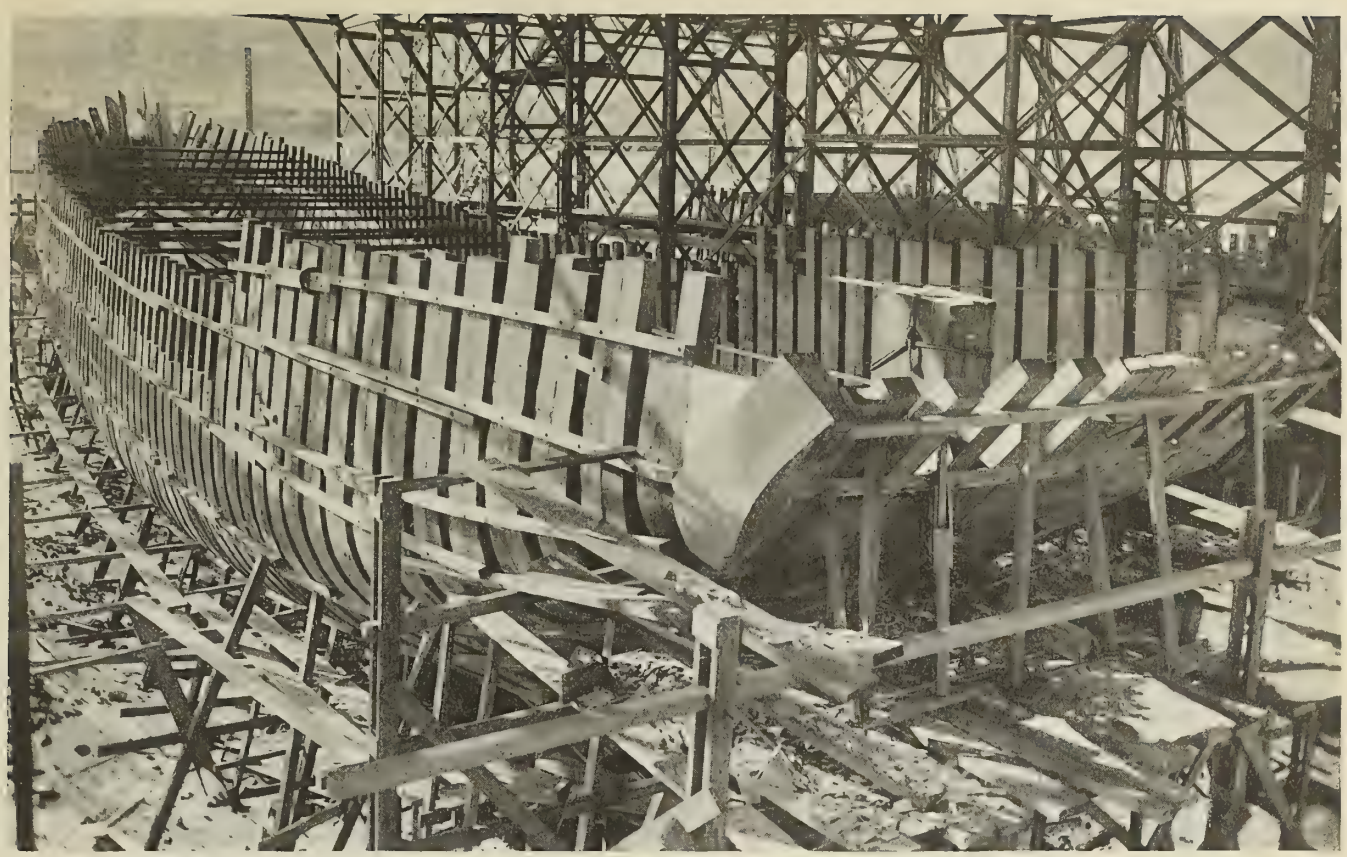


Fig. 4.—Vessel in Frame at Columbia Engineering Works

Fig. 5.—Deck View of Vessel Nearing Completion

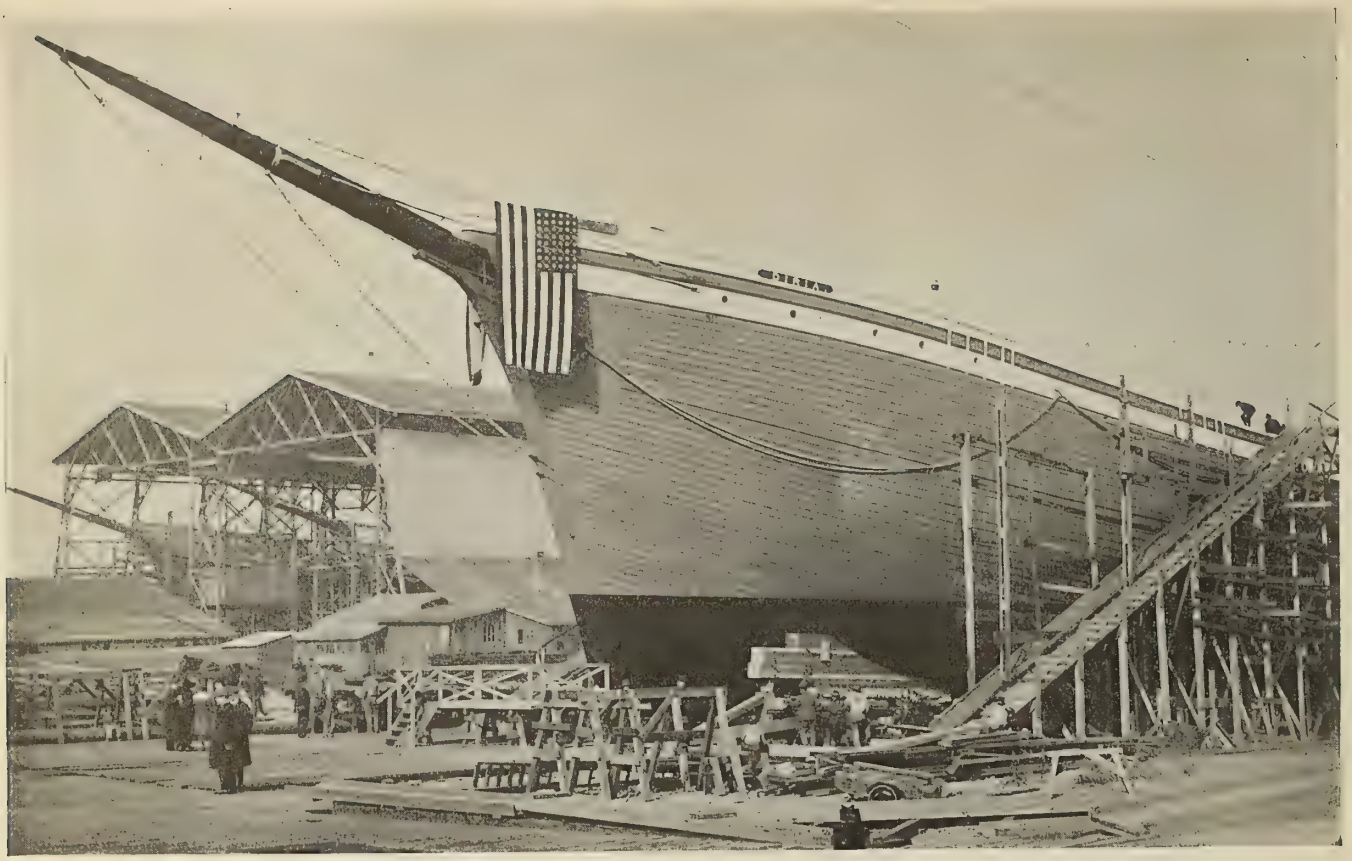


Fig. 6.—General View of Shipways

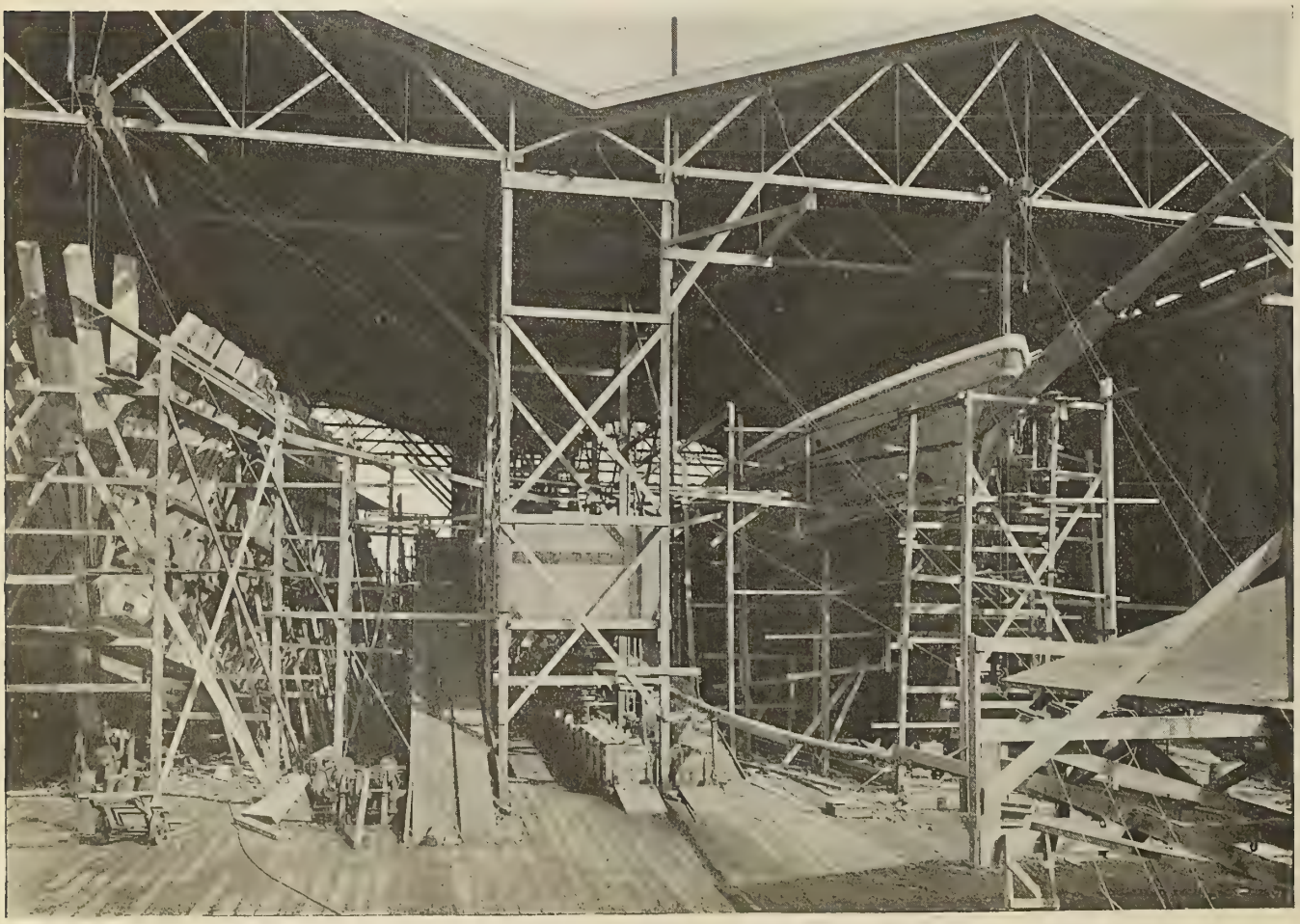


Fig. 7.—Covered Ways to Expedite Work in Winter Weather

Fig. 8.—Fabricating Yard and Saw Shed at Head of Shipways

Fig. 9.—Deck View of Finished Vessel, Looking Forward

Fig. 10.—Deck View, Looking Aft, Showing Cargo Winches

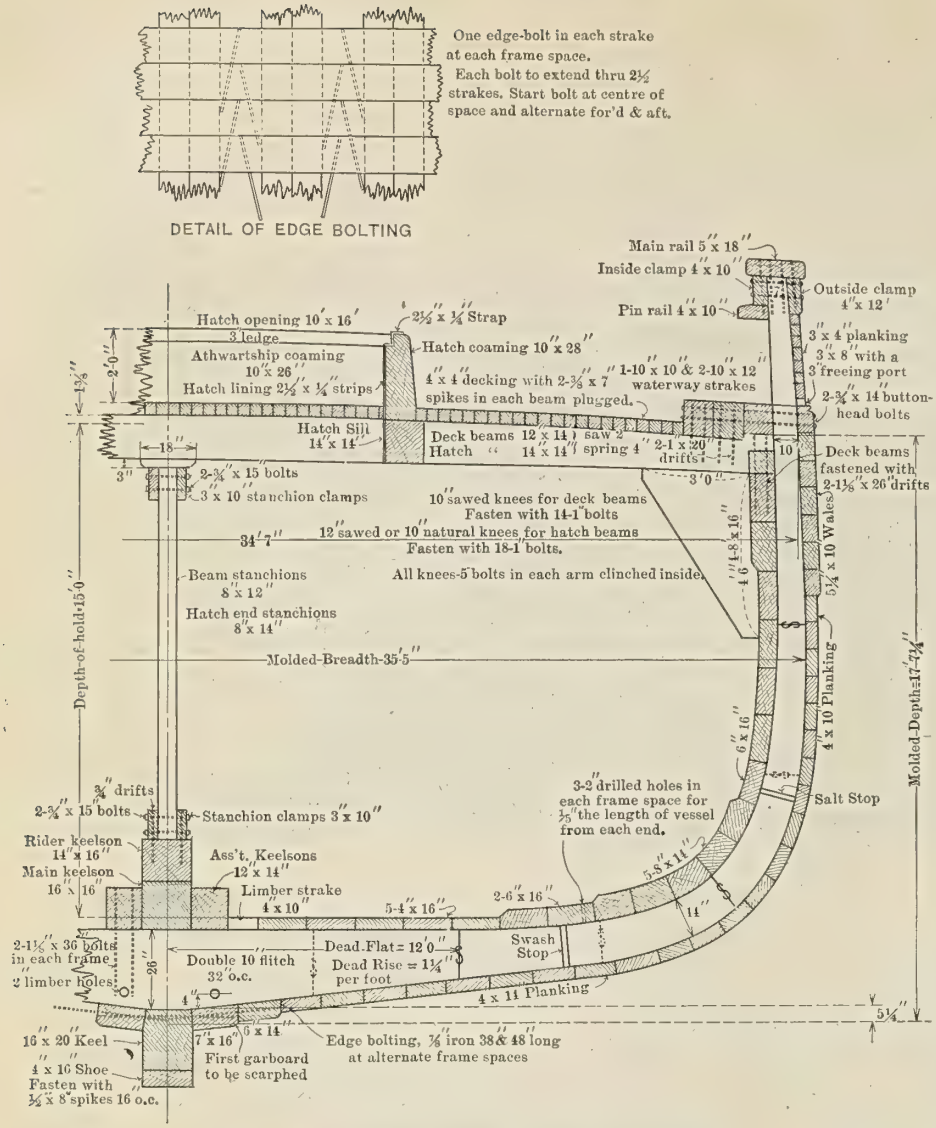

One edge-bolt in each strake at each frame space.
Each bolt to extend thru 2½ strakes. Start bolt at centre of space and alternate for'd & aft.
DETAIL OF EDGE BOLTING
Main rail 5" x 18"
Inside clamp 4" x 10"
Outside clamp 4" x 12"
Pin rail 4" x 10"
Hatch opening 10' x 16'
2½" x ¼" Strap
3 ledge
Hatch coaming 10" x 28"
Athwartship coaming 10" x 26"
Hatch lining 2½" x ¼" strips
4" x 4" decking with 2-⅞" x 7" spikes in each beam plugged.
1-10" x 10" & 2-10" x 12" waterway strakes
3" x 4" planking
3" x 8" with a 3" freeing port
2-¾" x 14" button-head bolts
Hatch Sill 14" x 14"
Deck beams 12 x 14 } saw 2
Hatch " 14 x 14 } spring 4
2-1 x 20" drifts
Deck beams fastened with 2-1⅛" x 26" drifts
2-¾" x 15" bolts
3" x 10" stanchion clamps
10" sawed knees for deck beams Fasten with 14-1" bolts
12" sawed or 10" natural knees for hatch beams Fasten with 18-1" bolts.
All knees-5 bolts in each arm clinched inside.
Beam stanchions 8" x 12"
Hatch end stanchions 8" x 14"
Molded-Breadth-35'-5"
Depth-of-hold-15'-0"
Molded-Depth-17'-7¼"
5¼" x 10" Wales
4" x 10" Planking
6" x 16"
3-2" drilled holes in each frame space for ⅕ the length of vessel from each end.
Salt Stop
¾" drifts
Stanchion clamps 3" x 10"
Rider keelson 14" x 16"
Main keelson 16" x 16"
Ass't. Keelsons 12" x 14"
Limber strake 4" x 10"
5-4" x 16"
2-6" x 16"
5-8" x 14"
2-1½" x 36" bolts in each frame
2 limber holes
Double 10" flitch 32" o.c.
Dead Flat = 12'0"
Dead Rise = 1¼" per foot
Swash Stop
4" x 14" Planking
16" x 20" Keel
4" x 16" Shoe
Fasten with ½" x 8" spikes 16 o.c.
7" x 16"
6" x 14"
First garboard to be scarphed
Edge bolting, ⅞" iron 38 & 48" long at alternate frame spaces

Fig. 11.—Midship Section of 184-Foot Vessel

Ordinarily, lumber is delivered to the yard by water, being rafted into an inclosed basin, whence it is lifted out of the water by a set of sheer legs operated by a donkey engine Material is also delivered by rail, as the yard is served by a branch from the Spokane, Portland and Seattle Railway, a branch of the Northern Pacific.

Equipment of the Yard

The yard is thoroughly equipped with machine, blacksmith and woodworking shops for manufacturing every part of the ships under construction, including the fittings, ship's tackle, steering gear, tanks, etc. The machine shop, shown in the foreground in the photograph, Fig. 1, is 130 feet long by 85 feet wide, with the main office and drafting room in an upper story at one end of the shop. The machine shop is equipped with six lathes, one with a 40-inch swing, milling machines, radial drill presses and other tools for manufacturing the ships' tackle, steering gear, turn buckles and other equipment.

Beyond the machine shop is a blacksmith shop, the equipment of which includes two 800-pound Niles-Bement-Pond steam hammers and five forge fires. The tank shop, 60 feet by 80 feet, with 25-foot head room, is equipped to handle plates up to ¾-inch thickness. The equipment of the tank shop includes a Bliss & Company double punch and shear, a Wangler bevel shear, a Badger splitting shear, a set of 8-foot Bertsch bending rolls, a Hanna bull riveter and Oxweld cutting and welding torches.

The mold loft, 50 feet by 120 feet, is located in a separate building. Underneath this is a storeroom for oakum, treenails and other supplies. At the head of the shipways is the main ship shed equipped with two ship saws, two band saws, one cut-off saw, a jointer, bevel planer and circular saw.

The tools throughout the plant are operated by either electric motors or compressed air. The capacity of the compressed air plant is 1,600 cubic feet per minute, and consists of four Ingersoll-Rand compressors, one of which is direct connected to a high-speed Steam engine, one Pratt steam-driven compressor and one Gardner compressor.

Shipways

The ship sheds are 55 feet height, 60 feet wide and 220 feet long. Under these covered ways the work can be carried on without interference during winter weather. All of the ways are served by overhead hoists of two tons capacity operated on cables. Power for operating one hoist is furnished by a Clyde three-drum reversible engine. At the fitting-out berth, which is arranged for fitting out four vessels at a time, a set of sheer legs of 10 tons capacity is arranged for stepping masts and handling other heavy equipment.

Types of Vessels Built

As shown by the illustrations, the vessels built by the Columbia Engineering Works are for the most part schooner rigged, known as the Pacific Coast type, with commodious accommodations for the officers in the poop and for the crew in the forecastle. As a representative type here is shown in Fig. 12 the sail and deck plan, and in Fig. 13 the midship section of a four-masted auxiliary schooner 184 feet long between perpendiculars, 35 feet 5 inches beam, molded, and 17 feet 7¼ inches depth molded to the main deck.

The main scantlings are shown on the midship section, and comply with both Lloyd's and American Bureau requirements. It will be noted that the depth of floors at the keel is 26 inches. At first glance this may seem excessive when compared with other designs, but attention is called to the fact that the usual heavy keelsons and ceiling are dispensed with. The results obtained have been very satisfactory as reported by the owners and operators of these ships.

As the strength of a wooden structure depends upon the fastenings, especial attention has been given to this feature in the design of these vessels, so that the full strength of the timbers will be secured.

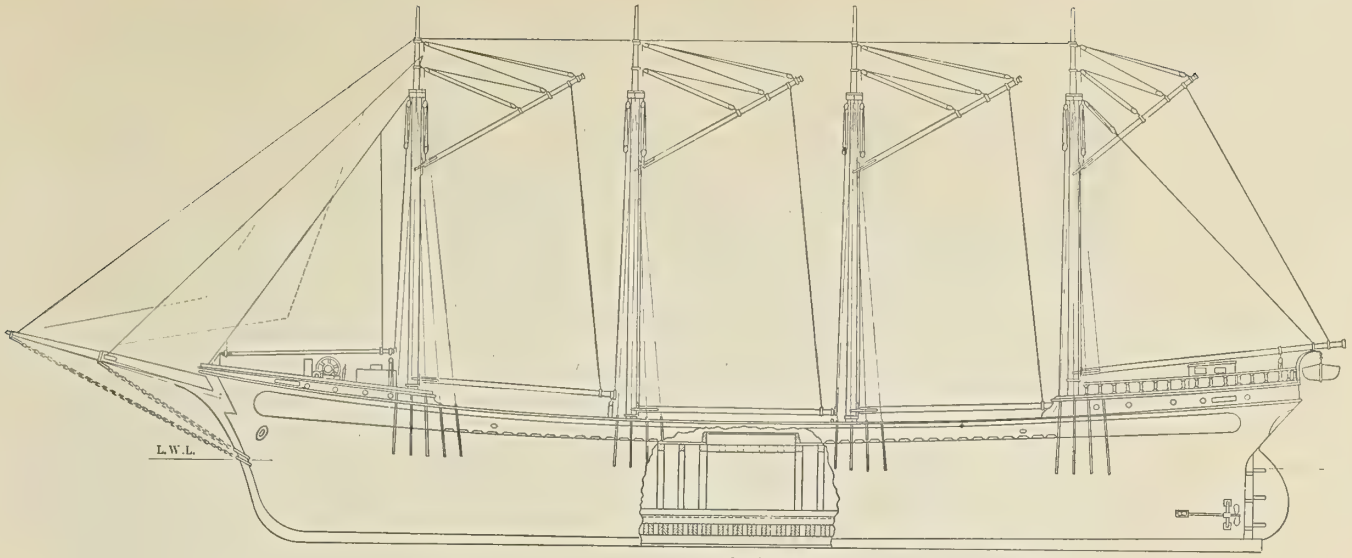


Fig. 12.—Sail and Deck Plan of Four-Mast Auxiliary Wooden Schooner

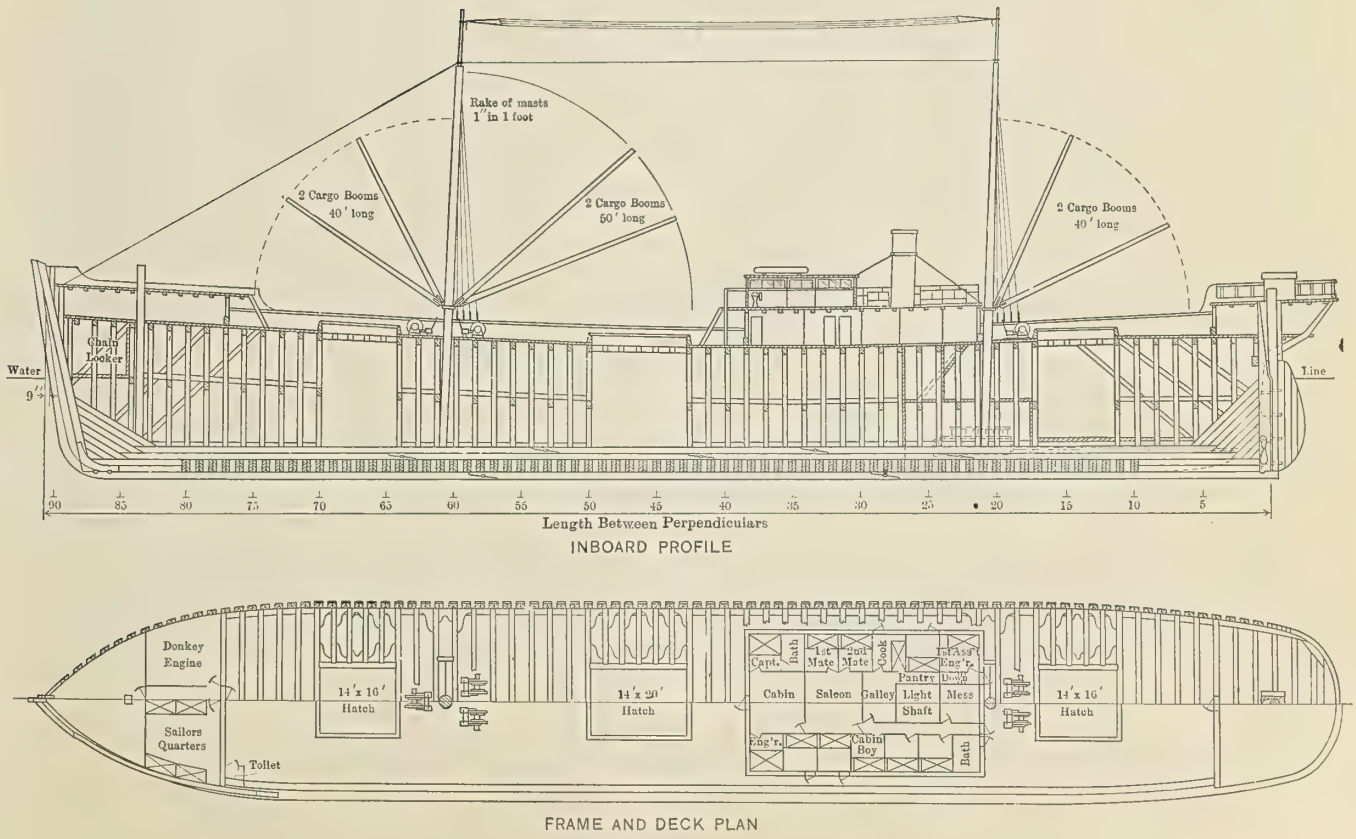


Fig. 13.—General Arrangement of Wooden Steamer

In discussing the design of wooden vessels, Mr. Arthur M. Mears, general manager of the Columbia Engineering Works, brings out the following interesting points:

It is a deplorable fact that many wooden ships have been improperly built, but that does not mean that a good and serviceable wooden ship is impossible to obtain at a reasonable cost.

If wooden ships were designed with as much care as steel ships failures would be very rare. In designing a steel structure, the joint is always considered the critical point, and the members selected accordingly. This holds true with a wooden structure as well, but it is very evident that most builders or designers fail to realize this, as is clearly shown by the fact that many ships are built with ceiling 10 inches to 12 inches in thickness and secured with edge bolts 1 inch to 1¼ inches diameter, 5 feet to 6 feet apart.

It is very easy to prove with figures, but quite self-evident, that with such fastenings the bolts would bend and the adjacent wood crush long before the total strength of the timber is reached. Not alone does the number and size of the bolts need to be examined, but the manner in which they are driven. The holding power of a bolt depends on the tightness with which it is driven, and will start with zero where the bolt is loose in the hole and increase until the wood is stressed past its elastic limit where the hole is too small. The Government has proved through extensive tests that it takes 50 percent more pressure to move a bolt contrary to the direction of driving than it took to drive the bolt. By the proper selection of the direction of driving considerable additional strength can be secured. The Government tests show that the maximum holding power of a 1-inch bolt per lineal inch is 2,500 pounds.

Weight of Material

In designing the structure of a ship there are three points which must be borne in mind: strength, cost and weight. The latter is often overlooked, but is very essential to the owner, as every extra ton of excess material used cuts down the carrying capacity and, therefore, the earning capacity of the ship. All parts should be relatively equal in strength as nearly as possible, but weight can also often be reduced by variations in design or placing of members. For example, the strength of a timber varies as to its sectional modulus $\frac{b\,h^2}{6}$, therefore a 10-inch by 24-inch flitch timber can be used in lieu of 12-inch by 22-inch, with a saving of about 10 percent in weight.

Possibly much of the trouble is caused by following blindly the old rules of the classification societies, which have not been revised for many years.

A vessel must be considered as a single member designed to withstand a certain maximum load, and its strength will vary as the square of the depth, other things being equal. Therefore, the rules of the societies based on tonnage alone give widely different relative strengths, and in the following rules one vessel might be of sufficient strength, while another one might be too weak.

Depth of Floors

The greatest difficulty experienced with wooden vessels has been with the floors coming up or "hogging," as it is sometimes called. There is such a variance in the design that it is evident that all designs cannot be correct. To show the variance, we give the tonnage of a few ships, with their depth of floors at keel. These are not freak ships, but have been designed by reputable firms of engineers:

Tonnage of Ship	Depth of Floors at Keel
2,200	24
3,500	18
3,500	26
2,600	26
2,200	30
3,000	18
2,800	24
2,400	15
1,200	26

By comparing the drawings of these vessels it is also evident that no account is taken of the location or shift of butts. With the ordinary design the butt is the critical point and should be the first point examined.

In many cases the double frames are not adequately fastened together, and the floor ceiling is only secured with spikes, which could easily give and allow the flitch to separate.

In lieu of sufficient transverse strength, many ships have excessive keelsons and heavy ceiling. These long keelson and ceiling timbers will bend and often break if picked up at their middle, so that it is impossible for them to keep the floors down. This is even more manifest when it is remembered that in the ordinary ship there are three or four of these long sticks end on, and they must be spliced together and bolted.

The reasons for the errors which are being made today are in nearly every case traceable to the change in conditions under which wooden ships are being built and to the following of rules intended for ships built of hard wood. There are many examples of wooden ships built of Douglas fir that have given many years of hard continuous service. One of the best examples of this was the old passenger and freight steamer *City of Mexico.*

Bending Frames For Wooden Ships

FREDERIC MERON, mechanical engineer, 2 Rector street, New York, has developed apparatus for heating and bending frames for wooden ships. In the first place, it is necessary to saturate the wood timbers by means of steam preparatory to subjecting the timbers to pressure for bending them to the required shape. Heretofore, this has been done mainly by subjecting the wooden timbers to high pressure steam in a sealed chest, or chamber, in which they were piled, one upon the other, with the result that the degree of saturation was not uniform over all of the timbers, nor over all of the parts of a single timber. Furthermore, with this method steam was wasted each time the steam box was opened for the removal of the timber, and the entire contents of the steam chest had to be removed before recharging the steam box.

Mr. Meron's invention is designed to obviate these difficulties and to afford a simple means whereby the process of saturation of the wooden timbers may be rendered continuous with the use of low pressure or exhaust steam, so that all sides of each piece are treated uniformly and effectively exposed to the moisture. With this apparatus the treatment given certain timbers may be varied to conform to the various requirements of the different grades or kinds of wood used or the purpose for which it is to be employed.

In addition to this, Mr. Meron has devised apparatus for the shaping of the wood after it is steam heated, so that the parts may be turned out in quantity.

Safety and Relief Valves—II

Special Features of Valves for Saturated and Superheated Steam—Piping Arrangement—Testing Pop Valves

BY M. W. LINK*

THE question of the amount of piping allowable in the installation of a pop valve has been discussed in the technical papers since the advent of the pop valve. It is, however, of such importance that it should always be kept in mind when pop valves are installed.

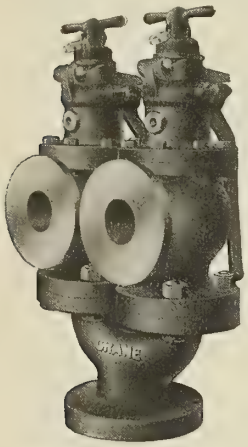


Fig. 4.—Twin Pops

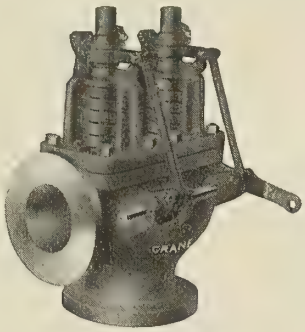


Fig. 5.—Duplex Pop

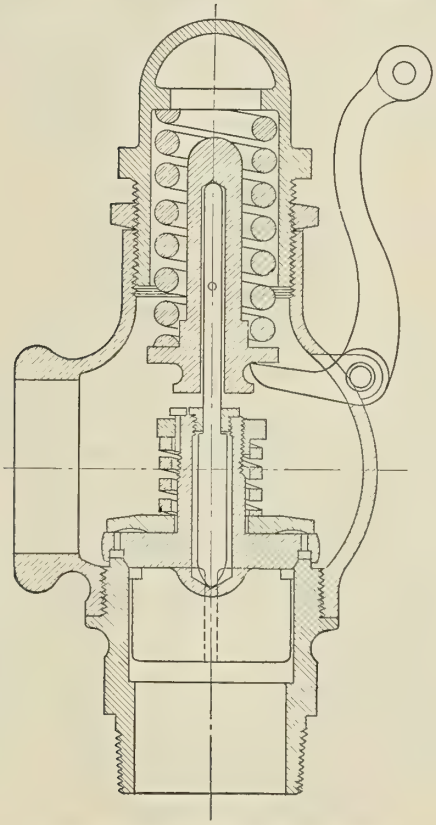


Fig. 6.—Brass Marine Pop Valve

Briefly stated, for a general rule, no pop valve should be installed with any pipe between the boiler and the pop valve, except *when the pipe is two pipe sizes larger than the valve* and the length of this pipe is less than 24 inches.

On account of the objectionable noise created by the escape of steam from a pop valve and also to conserve steam, it is customary to pipe the outlet of pop valves. On the ordinary type of encased inside spring pop this piping is allowable within reason. On any inside spring type of valve this piping is an objection unless considerable judgment is used in the exhaust piping, etc.

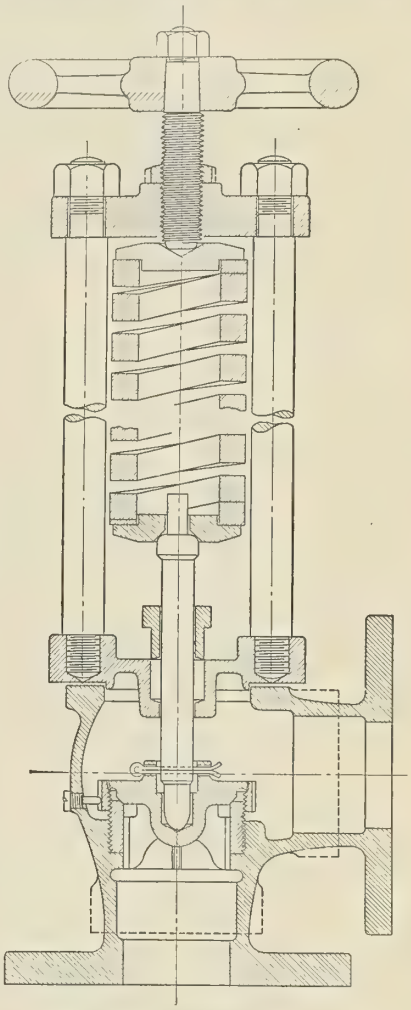


Fig. 7.—Water Relief Valve

The successful operation of a pop valve with and without piping in the *outlet* is due to the prevention of the accumulation of a back pressure in the body of the valve above the main disk. In the encased spring type of valve this back pressure usually cannot set up any detrimental action on the disk and spring.

In the inside spring type of valve, this back pressure changes the result of the action of both the spring and the huddling chamber, to such an extent that the valve will chatter and tend to cause the blow-back of the valve to alter with every pop.

The successful operation of a pop valve, when piping is used between the *boiler and the inlet of the valve,* is due

* Assistant mechanical expert, Crane Company, Chicago, Ill.

to the prevention of any drop in pressure in the inlet piping by the use of large pipe.

As the velocity of the steam in this pipe would, ordinarily, be extremely high, the drop in steam pressure, due to resistance, would also be high, causing an earlier closing of the pop than desired, thereby producing chatter of the pop disk.

On any high lift valve it is necessary to place the valve directly upon the boiler or on a properly designed base and also to increase the outlet piping one pipe size to prevent chatter.

Superheated Steam

Safety valves for this service should be of the direct spring loaded pop type and have steel bodies and yokes. The seat and disk should be of a nickel alloy, having the same coefficient of expansion as cast steel. Monel metal is the ideal metal for this service. The springs on these valves should be of the outside exposed type, and should also be protected from the disturbing effects of escaping steam. The springs should be crucible steel, drawn at a temperature of not less than 600 degrees F.

The stem should be of drop forged steel, with a seating point on bevel seat valves below the valve seat. See Fig. 12.

The disk should be connected to the stem so that by raising the outside lever the disk will be lifted from its seat.

Saturated Steam

Safety valves for this service, on boilers, are invariably of the twin or duplex type. Valves should be of the direct spring loaded pop type. Bodies and bonnets to be of high grade cast iron, semi-steel or cast steel. The seat and disk to be of high grade brass; some prefer seats of a nickel-alloy, which seems to stand up better on the higher pressures.

Springs may be of the outside type, which are to be preferred on pressures above 175 pounds. If springs are of the inside type, they should be encased; i. e., free from the disturbing action of the escaping steam and also to prevent the back pressure in the valve piping from interfering with the working of the valve. This back pressure is the result of marine practice requiring the piping up of the outlet of the safety valve.

Twin valves, that is, two single safety valves mounted on a twin base, are the safest and best type to use, but, owing to the extreme head room required and extra flanged joints, are not always used. The advantages of having two independent valves should offset the disadvantages quoted above, whenever it is possible to use the twin pattern. See Fig. 4.

Duplex valves, that is, two sets of trimmings in one body, are the most popular for marine service. By their use there is but one joint between the boiler and the safety valve. Head room is reduced to a minimum.

The design, however, presents some inherent difficulties. Great care must be taken in the design of the body so that casting strains do not cause distortion of the seats. The seats must be so placed to prevent leakage due to strains set up by the changes in boiler shell (Scotch marine type of boilers). Piping connections on the outlet of the boiler must be carefully made and anchored to prevent distortion of the valve body. Broadly speaking, the duplex type must be treated with more consideration to prevent leakage, etc., than the twin type. See Fig. 5.

In the past, triplex and quadruplex pops were used, mostly with brass bodies. These types are being discarded because of the distortion strains and multiplicity of other difficulties. It certainly is a step in the right direction to eliminate the triplex pop.

The spring and disk of all steam pop valves should be connected so that the disk may be raised from its seat by lifting the outside lever of the valve. The springs

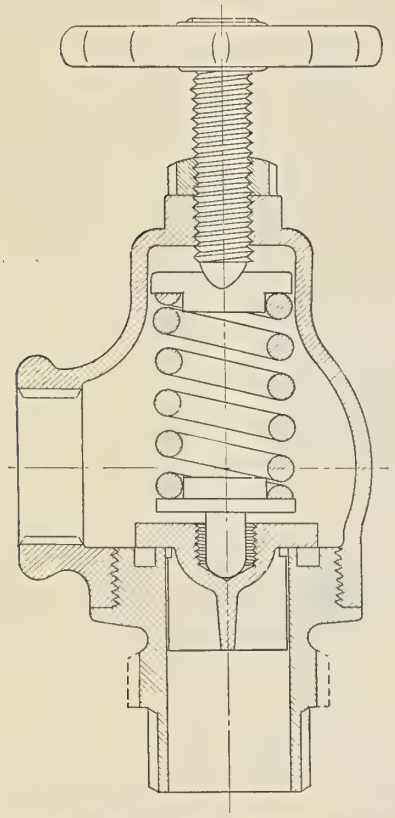


Fig. 8.—Brass Relief Valve for Hot Water

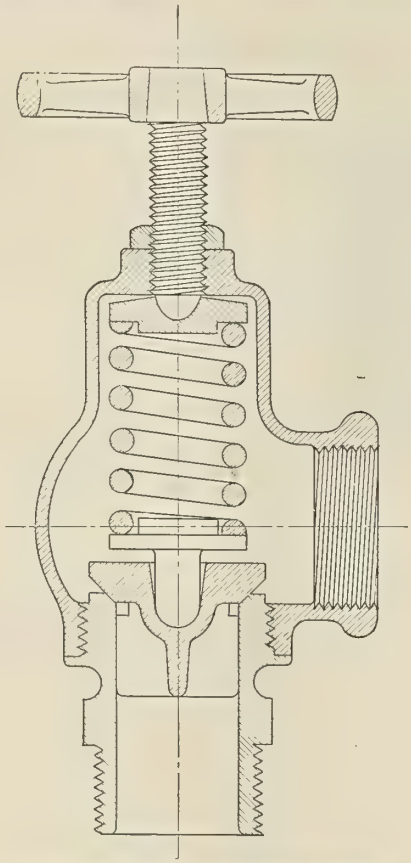


Fig. 9.—Brass Oil and Water Relief Valve

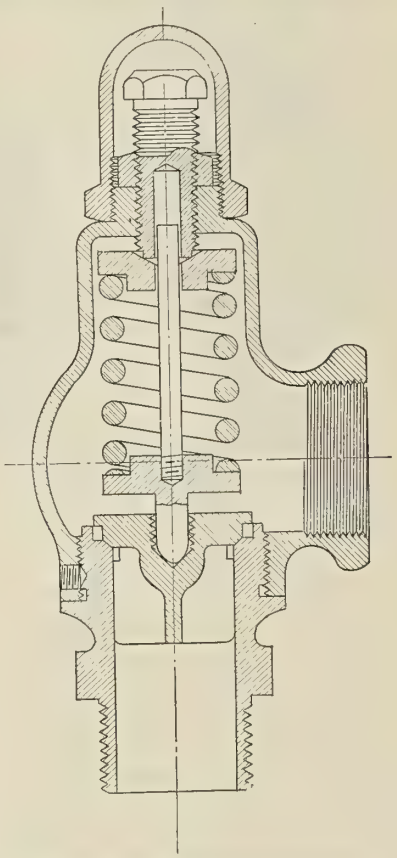


Fig. 10.—Brass Cylinder Relief Valve

should be of such length and design that the disk may be raised from its seat by the outside lever ⅛ of the valve diameter when there is 75 percent of the popping pressure in the boiler. Valves for Lloyd's requirements must be arranged so that the disk may be reground by turning the stem from the outside of the valve, which, by the way, helps ruin the seat bearing. A further Lloyd's rule calls for a device which, when the valve is locked and sealed, prevents the spring from being compressed beyond the original set pressure.

Brass Pop Valves for Saturated Steam

The majority of valves used for this service are made with a male thread on the base. This is good practice and the use of flanged bases and bases with female threads should be avoided. Flanged bases in brass spring easily when being bolted into place. Female bases cause more leakage, due to the practice of using pipe cement on the pipe. This cement works into the valve at the first pop and usually stays long enough to ruin the bearing at the seat.

The general design of the brass pop should follow the iron as far as possible. The use of brass pops larger than 2 inches should be avoided. There is no advantage in their use and the initial expense is not compensated for the service rendered. See Fig. 6.

Relief Valves for Hot Water

For high pressure, the design shown in Fig. 7 has been found the most satisfactory.

For medium pressures and small sizes, the design shown in Fig. 8 is recommended. The blow-down with this type is usually about 10 percent of the set pressure.

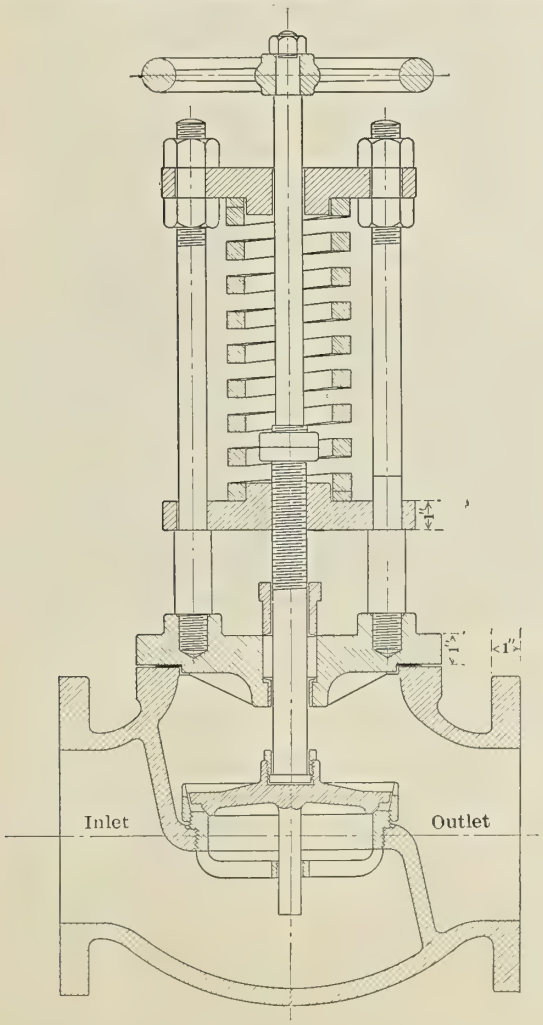


Fig. 11.—Safety Valve for Back Pressure Line

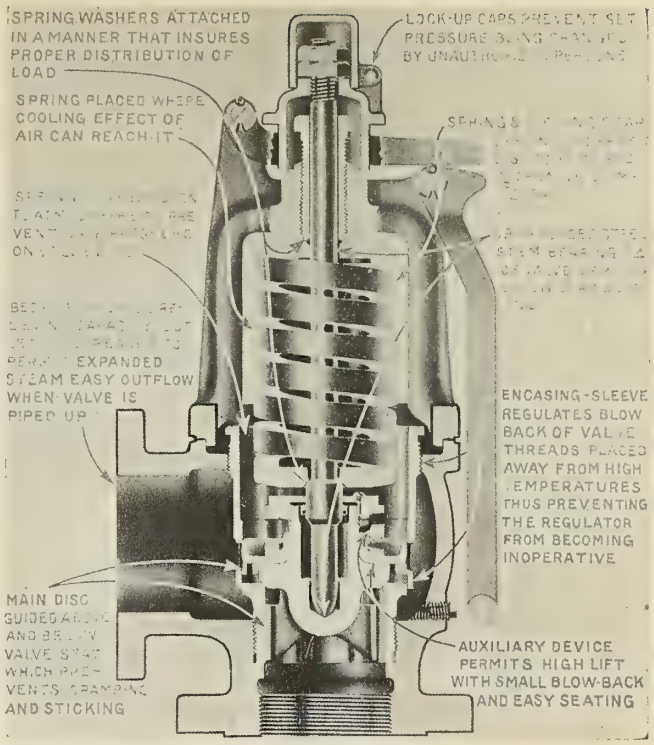

SPRING WASHERS ATTACHED IN A MANNER THAT INSURES PROPER DISTRIBUTION OF LOAD
SPRING PLACED WHERE COOLING EFFECT OF AIR CAN REACH IT
EXPANDED STEAM EASY OUTFLOW WHEN VALVE IS PIPED UP
ENCASING-SLEEVE REGULATES BLOW BACK OF VALVE THREADS PLACED AWAY FROM HIGH TEMPERATURES THUS PREVENTING THE REGULATOR FROM BECOMING INOPERATIVE
MAIN DISC
AUXILIARY DEVICE PERMITS HIGH LIFT WITH SMALL BLOW-BACK AND EASY SEATING

Fig. 12.—High Pressure, High Capacity Valve

For cold water and oil, design shown in Fig. 9, owing to its simplicity, is recommended. The blow-down is about 20 percent of the set pressure.

For snifting and cylinder relief valves, valves with the fewest number of parts are extremely important. Fig. 10 shows a design which has been in successful use for over 25 years.

Safety Valves for Back Pressure Lines

Fig. 11 shows a type of valve which is recommended for back pressure marine service. It contains all features necessary for successful operation:

1. Outside spring.
2. Handwheel control.
3. Stuffing box on "vacuum" side.
4. Adjustment to vary back pressure.
5. Huddling chamber to give popping action.
6. Indicator to designate what condition of valve may be applied.

The objections are high head-room, necessity for installation in a horizontal line and initial cost.

There is no better method of illustrating all the features of a design which make a successful high pressure, high capacity valve than that shown in Fig. 12. A 3-inch duplex valve shown in Fig. 5, having the design as shown in Fig. 12, has a discharging capacity of 26,500 pounds of steam per hour at 200 pounds boiler pressure and 3 percent over pressure rating.

Testing Pop Valves

A few hints may prove of value when testing any pop or relief valve.

1. Be sure your testing gage is correct.
2. See that your valve is clean—absolutely clean.
3. Test water valves with water.
4. Test steam valves with steam or air. (Not water.)
5. Thoroughly understand the valve you are testing.
6. When testing, have enough steam or water to meet

approximately the discharging capacity of the valve under test.

7.—Don't lift the disk of a steam pop from its seat when cold. Wait until the pop heats up.

8.—Always install safety and relief valves with the stem in a vertical position.

Highly Superheated Steam Used on Steamship Pearl Shell

THE bulk oil tank steamship *Pearl Shell,* owned by the Shell Oil Company, of California, is a recent production of the Harlan & Hollingsworth Corporation, Wilmington, Del. The vessel was launched in 1916, and is an excellent example of some of the more recent additions to the United States merchant marine. The principal dimensions are:

Length over all	411 feet 6 inches
Beam	53 feet 4 inches
Molded depth	29 feet 8 inches
Gross tonnage	5,845
Net tonnage	5,310

As is customary in vessels of this class, the machinery is located aft. Propulsion is by an inverted, direct-acting, triple-expansion, reciprocating engine of 2,400 horsepower, with cylinders 29 inches, 45 inches and 74 inches diameter, and 48-inch stroke. The high pressure cylinder, placed forward, is equipped with a piston valve having solid rings; the intermediate is in the middle and has a slide valve with M. & S. relief frame; the low pressure is aft and is fitted with a plain slide valve. The engine is designed to turn about 66 revolutions per minute at 65 percent cutoff. Copeland packing is used on the high pressure piston rod, and all piston rings are Lockwood & Carlisle.

Steam at 180 pounds pressure is supplied by three single-end Scotch boilers 15 feet 8 11/16 inches outside diameter and 11 feet 7 inches long, located two athwartship and one forward, all having a common stoke hold. Each boiler has three Morison corrugated furnaces and 358 3-inch outside diameter tubes, which provide an evaporating surface of 2,667 square feet, while the grate surface is 64.4 square feet. The stack is double, and is 8 feet 6 inches by 75 feet. The boilers are operated under Howden forced draft and are arranged to burn either coal or oil. Originally the fuel was coal, but at present oil is being used.

One of the most interesting features of the *Pearl Shell* is the use of highly superheated steam. The superheating of the steam is accomplished by means of a firetube superheater manufactured by the Locomotive Superheater Company, 30 Church street, New York. The arrangement of the superheater equipment is shown in Fig. 2. Each boiler has four cast steel headers or collectors. These are arranged in pairs, each pair having one saturated and one superheated header, and are connected by units of cold drawn, seamless, steel tubing, which extend into the boiler tubes. Each pair of units is attached to the headers by means of a clamp and stud, and may be released by removing a single nut. The units are of the continuous type, and have return bends formed integral from the tubing. The superheater is designed to provide steam at a temperature of 600 degrees F. at the throttle under normal operating conditions. Reports from the vessel indicate that this temperature can be maintained very closely.

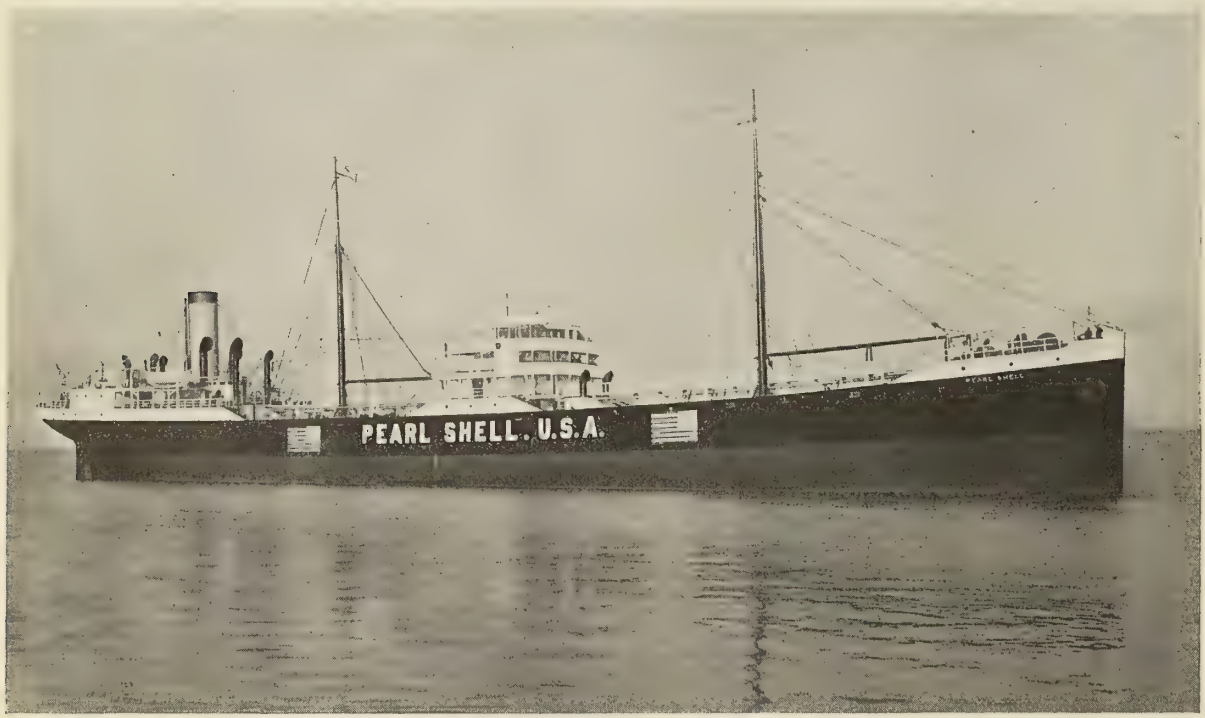


Fig. 1.—S. S. *Pearl Shell,* Built by Harlan & Hollingsworth Corporation for Shell Oil Company of California

The use of highly superheated steam is becoming more and more general in marine practice as its advantages in fuel saving, increased power and speed and greater steaming radius from a given amount of fuel are recognized. There are now more than 2,200,000 horsepower of marine engines receiving highly superheated steam from superheaters of the firetube type, and large numbers of ships now under construction include firetube superheaters in their equipment.

The *Pearl Shell* is one of the vessels recently taken over by the United States Government.

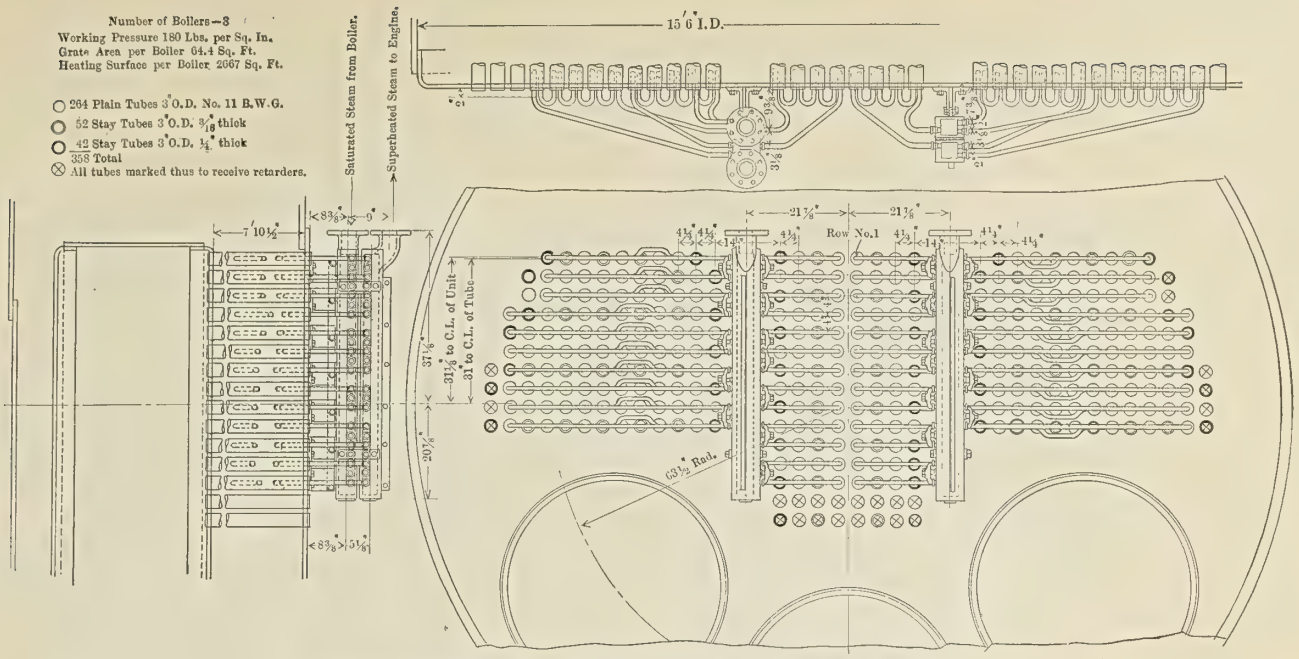

Number of Boilers—3
Working Pressure 180 Lbs. per Sq. In.
Grate Area per Boiler 64.4 Sq. Ft.
Heating Surface per Boiler 2567 Sq. Ft.
264 Plain Tubes 3" O.D. No. 11 B.W.G.
52 Stay Tubes 3" O.D. 3/16" thick
42 Stay Tubes 3" O.D. 1/4" thick
358 Total
All tubes marked thus to receive retarders.
Saturated Steam from Boiler.
Superheated Steam to Engine.
15' 6" I.D.
Row No. 1
63 1/2" Rad.

Fig. 2.—Arrangement of Superheaters on Boilers of S. S. *Pearl Shell*

New York Barge Canal Terminals

DURING the past year work has steadily progressed in completing the terminal dock walls and grading the sites at the various locations. On the majority of the up-State terminals temporary warehouses have been constructed, with the thought of accomplishing a double purpose, namely, to provide temporary facilities for handling freight and postpone the permanent construction until conditions in the labor and material markets are more favorable, and by the use of these temporary facilities to observe actually the results obtained at each terminal, since such information will be invaluable in planning the permanent work.

In Greater New York the construction of Barge canal terminals is in progress at the following locations: West Fifty third street, North River; Piers 5 and 6, East River; Greenpoint; 138th street, Harlem River, and Gowanus Bay. At this latter location there has been some discussion as to the possibility of constructing a grain elevator; but the State has never definitely committed itself to such construction. This site at Gowanus Bay is admirably located for elevator purposes. Knowing that the Federal Government would be called upon to make provision for sending oversea millions of bushels of grain to supply both our expeditionary forces and our Allies, the availability of this site for an elevator was brought to the Government's attention, and the State offered so to construct the pier now in process of building that, without interfering with its usefulness for general cargo-handling, it could also serve as a part of a 10,000,000-bushel elevator, which might easily be constructed on this site. No definite action has yet been taken by the Federal Government as to the construction of such an elevator.

During the past year considerable progress has been made in arriving at a settlement with the owners from whom property was appropriated in Greater New York for terminal purposes. Due, however, to the constant fluctuation in prices governing construction, it is not yet possible to arrive at any close estimate of the probable cost of development at the various sites now owned by the State. There is constantly being brought to the attention of the State Engineer sites which might be acquired and on which Barge Canal terminals could be constructed. In the majority of cases the locations suggested are susceptible of development and would be of benefit to the locality. The State is now the owner of waterfront property in Greater New York which will have been acquired as the result of the expenditure of a large sum of money. To ever realize on the investment the State must develop this property, and such is the present policy of the State in the matter. Until the work has further advanced and a closer estimate can be made of the ultimate cost of such development, the State is hardly in a position to obligate itself to construct additional terminals for which the sites have not been acquired. In arriving at this conclusion the fact has never been lost sight of that no provision for constructing terminals has been made for many sections of Greater New York where such construction is justified.

I am still of the opinion that the terminals are vital to the success of the canals, and I am bending every effort so to plan and construct them that on their completion they will efficiently and economically serve the needs of traffic and the requirements of shippers. It is certain that when they do demonstrate their value further appropriations must be made, not only to increase the equipment on those already provided, but to build additional ones.—*From annual report of New York State Engineer.*

It is a wise man who cuts in a valve between the boiler and the "blow." It will save much trouble and perhaps a life. Why this is not always done when the ship is building is difficult to understand, as it would then cost little. There is room for improvement in the construction of blow-off cocks, and greater attention should be paid to locating them so that they can be more conveniently reached.

In very highly rotative machines ring oilers sometimes do not act satisfactorily, as centrifugal action throws the oil from the ring. This trouble can be entirely averted by cutting a groove on the inside of the ring; in fact, this idea is an advantage if used in all ring oilers.

Letters from Marine Engineers

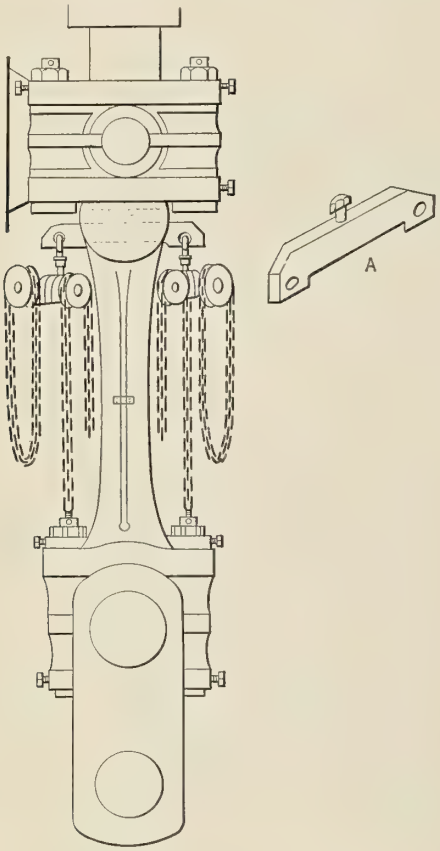
Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Chain Falls Strongback

Perhaps a sketch of the form of strongback used for rigging up the chain falls while overhauling main engine crank pin brasses may help others to more easily understand the best way to rig up heavy falls for such work on open-forked connecting rods.

The sketch is self-explanatory, but a word may make it clearer. The strongback is made of 7/8- by 4-inch plate steel, cut as shown in the small sketch *A*. A 5/8-inch



Method of Lifting Crank Pin Brasses

screw is used in the center. The strongback is put in, or saddles the center of the fork of the connecting rod, and the screw is then unscrewed out of the strongback until it meets the bottom of the piston rod or crosshead. This clamps the device in place, and the falls are hooked into the holes as shown.

Single chain falls with special eye bolts are best for the work. These permit the lowering of the brass without making a shift as when using special slings, etc. It is hoped that others will find these notes useful and the writer will appreciate suggestions from others.

O. N. Watch.

Planer Clamps

Two somewhat odd, but useful, types of planer clamps that can be forged up and machined easily by the ship's force are shown in the sketches.

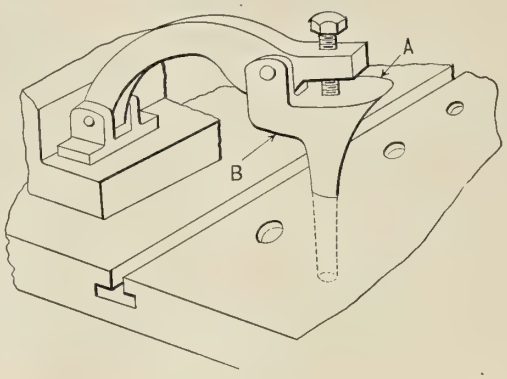


Fig. 1

The type in Fig. 1 is held fast by the fit of the taper leg in the hole by tapping at *A*. When necessary to shift it by prying up at *B*, it is readily removed

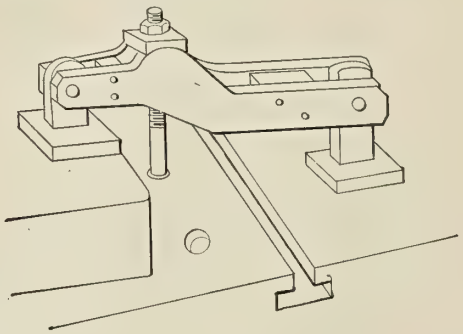


Fig. 2

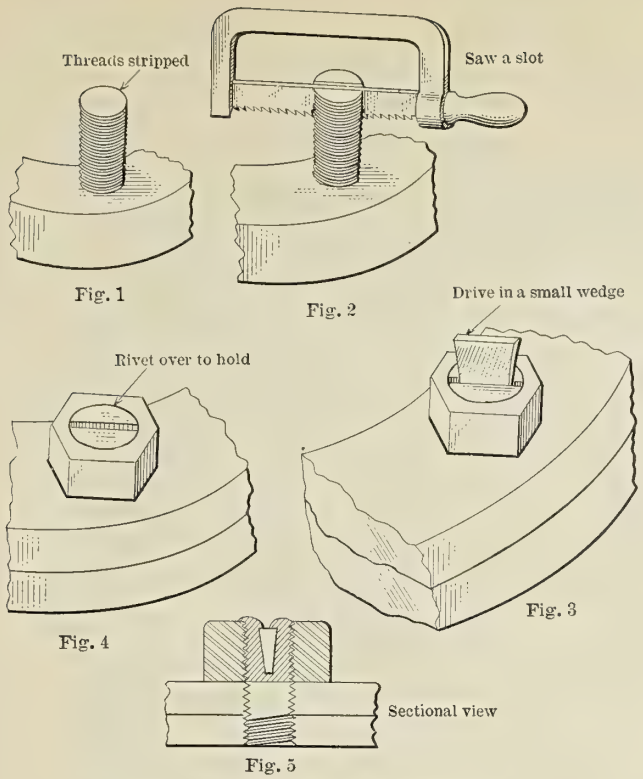
Hardly any description as to the construction of either clamp seems necessary, for the sketches talk best. The clamps are made in sizes to suit the maker, therefore no dimensions are given. Chief Machinist.

A Few Wrinkles

Here are a few more wrinkles, or kinks, that the writer has added to the pages of his note book, and that may be deemed by other readers of Marine Engineering worth collecting for their use. The sketches are rather rough, but they serve to convey the ideas more clearly than words.

Figs. 1 to 5 show how to get around the disagreeable job of repairing a stripped stud. We all know what a mean job it is to have to take one out that is frozen in; then again, it is not always likely that we may have a new stud of the same size. There are many other reasons that the scheme shown may be welcome when one meets up with a stripped stud.

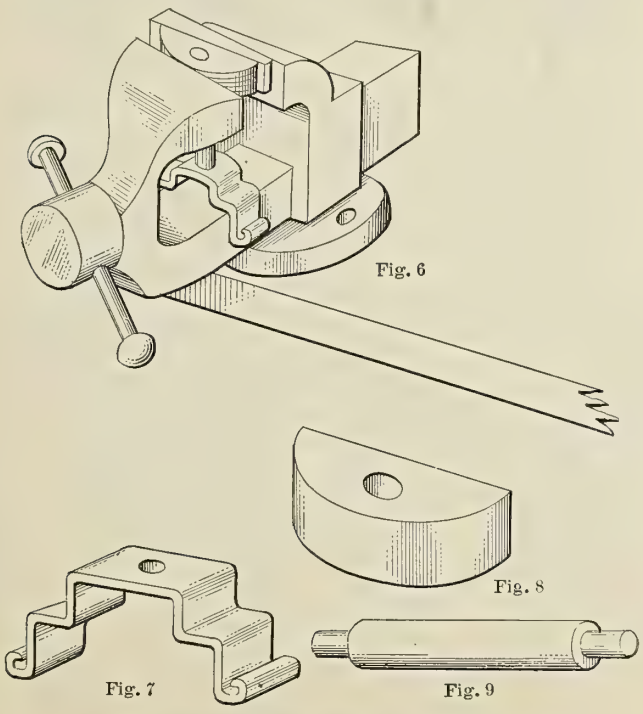
The attachment for a solid jaw vise shown in Figs. 6 to



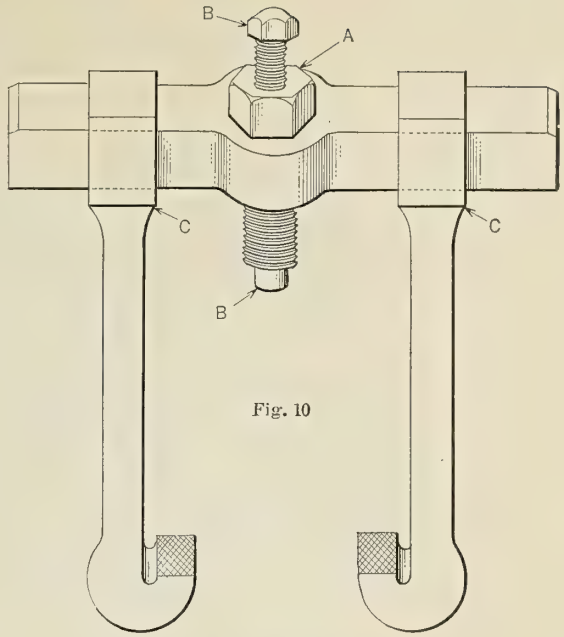
Emergency Repairs to Stripped Stud

9 is very simple and easy to make, and those who are not fortunate in having a swivel back jaw to their vise will welcome this wrinkle.

The gear, pulley, or fly-wheel puller shown in Fig. 10 is the best thing yet that I have ever come across for this business. We had to remove the vane impeller wheel from the shaft of our main circulator a while ago, and, after trying several of the old strap and bolt schemes with poor success, one of the oilers handed out this idea of a double screw in the center of the yoke; the idea, of course, being to prevent the bending of the screw. A large screw



Attachment for Solid Jaw Vise



Pulley and Fly-Wheel Puller

A was made, drilled and tapped to take another screw of smaller size through its center, as indicated at *B*. To use the puller, the arms *C* are put in place, and the large screw *A* used to start the impeller or fly-wheel off. This screw is used to pull the first and stiffest part of the work; the smaller screw *B* is used to pull the wheel off the remaining distance. This type of puller is a jim-dandy and easy to construct. Make all its parts rugged and of good steel.

Concord, N. H. C. H. Willey.

Adjusting Marine Engine Bearings*

BY WILLIAM M. MC ROBERT

ONE of the most important of the many duties of a marine engineer is the adjustment of the main engine bearings. To engineers who have operated on lake or river steamers it might be said that running an engine on the ocean is a little different from operating on inland

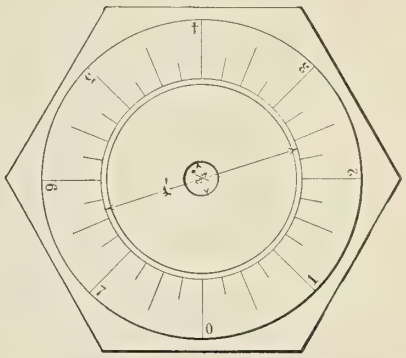


Fig. 1.—Nut Marked to Facilitate Adjustment

waters, for it is the practice on fresh water to allow a stream of water to flow continuously on most of the bearings to avoid overheating and to reduce the amount of lubricating oil used. This cannot be done at sea, as the salt and other solid matter in the water would ruin the bearing in a short time, so that dependence is on oil alone.

When an engineer joins a ship with which he is un-

* From *Power*.

familiar, he should, in order to avoid trouble while on a voyage, examine and adjust all the main bearings and the crank and crosshead brasses. When proceeding to adjust a bearing and before taking off the nuts, they should be marked so that their respective positions may be known and the amount, if any, taken up in adjustment determined. To make the nuts readily distinguishable they should be typed *P* for port and *S* for starboard, together with the number of the particular bearing to which they belong. The nuts on No. 1 bearing would therefore be designated as *P*1 *S*1, for when looking toward the bow of the vessel the side to the left is known as port and to the right is starboard.

A simple and permanent method of marking the nuts so that mistakes in adjustments are practically eliminated is shown in Fig. 1. Prior to slackening back a nut cut an arrow on the bolt with a thin, sharp chisel and make a light mark on the nut to coincide with it. Next remove the nut to the vise and graduate off somewhat as shown, using the mark already made for the zero or starting point. A piece of wood is necessary as a center for the nut when laying off the graduations with a pair of compasses and a sharp, flat chisel.

The arrow on the bolt will be used as the base from which all readings are taken, and a record of the position of each nut should be kept for reference in a manner similar to the following:

S. S. ..... At Port of ..... Date.....

MAIN BEARINGS

	Port Nuts Adjustment		Starboard Nuts Adjustment	
No. 1	Before....4½	After....4¾	Before....6¼	After....6½
No. 2	Before....5	After....5½	Before....2½	After....3
No. 3	Before....6	After....6¼	Before....3¾	After....4¼
No. 4	Before....1½	After....1⅝	Before....5¼	After....5⅞
No. 5	Before....3¼	After....3¾	Before....4½	After....5
No. 6	Before....2½	After....2¾	Before....6½	After....7

All bearings including the crank bearings should have the same kind of record.

Having marked and removed the nuts from the bolts on one of the main bearings, for example, the engineer lifts the cap clear of the journal by means of a chain or rope block, then lifts off the liners, noting down their number and description so as to replace them after cleaning thoroughly. In marine work soft lead wire is generally used to ascertain the clearance between the wearing surfaces. To do this, take two pieces of wire and place one, circumferentially, on each end of the journal within two or three inches of the ends of the bearing surface. On a large engine three "leads" should be used, the additional one at the center of the bearing. Care must be taken that the wire is a little shorter than the exposed part of the shaft or the ends will get on top of the liners when the cap is put on. Making sure the leads are in their proper positions (a little soap or grease will keep them in place), lower the bearing cap, put the nuts on and tighten them simultaneously until they are at their respective marks or perhaps a little past them, until the cap is "solid" on its liners. Notice particularly whether the cap is solidly down on the liners; if not, insert an extra liner to make it so. Again mark and slack off the nuts and lift the bearing cap and gage the leads for thickness and the uniformity to which they are squeezed out. Any desired adjustments may be made by removing or adding liners as occasion demands. Next comes the connecting rod alinement and the adjustment of crank and crosshead bearings, referring to Fig. 2.

Every steamship engine is equipped with either a steam- or hand-operated turning engine for the purpose of setting the engine in any required position to effect repairs. Prior to moving the engine, take a look over the stern of the ship to see that there are no boats or ropes near the propeller, and also be sure that the engine itself is clear of obstructions; then by means of the turning engine put the high pressure crank on the top center. On the face of the crosshead-shoe guide will be found two tapped holes, to which a piece of plate or a casting may be attached to support the piston and connecting rod when the rod is disconnected from its crankpin. After this "guide plate," as it is called, is securely bolted in place, attach to each side of the crosshead a differential chain block. Mark the position of the crank bolt nuts, as in the case of the main bearings, then slacken them back after screwing an eye bolt firmly into the threaded holes in the ends of each of

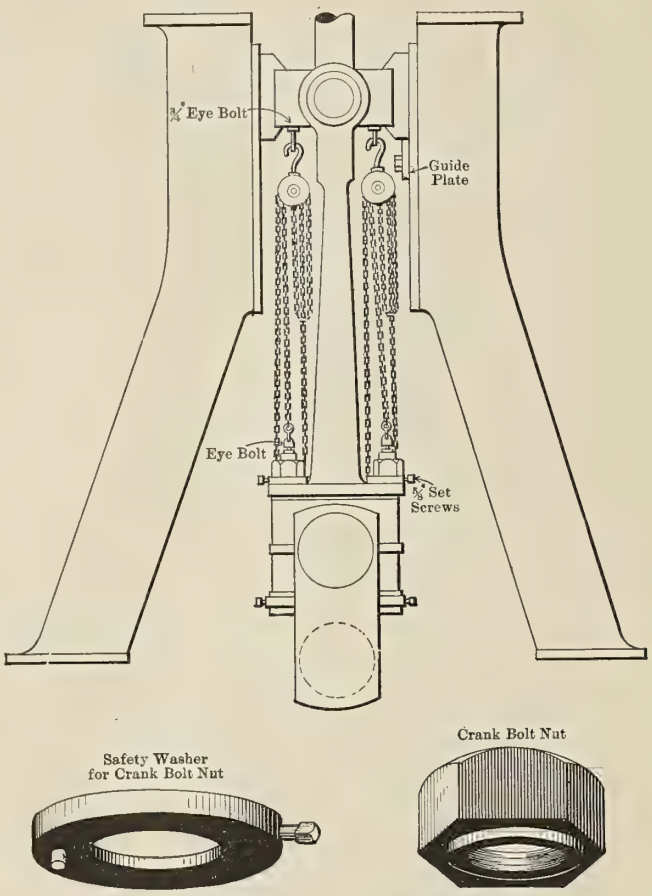


Fig. 2.—Unshipping a Crankpin Bearing

the connecting rod bolts and pulling up slightly with the two chain blocks; next lower the bottom half of the bearing gently on both tackles until it rests in the crank pit. The eye bolts and also the hooks on the chain block are small enough to pass through the bolt holes so the lower half can be lowered into the crank pit, or in case of small engines a rope sling may be used from the eye bolt to the hook. A rope sling is sometimes used in place of the eye bolts to support the chain blocks at the crosshead. With the turning engine turn the crank slightly ahead until the crankpin is just clear of the top half of the bearing, first making sure that the latter is held in place with a capscrew passed through each of the flanges. Keep the bearing off the crankpin, and with a pair of inside calipers measure to see if the end of the connecting rod is hanging central between the webs of the crank. In order to obtain smooth running, this condition must be realized.

Should the connecting rod be out of alinement, it may be corrected by inserting a thin liner between the lower crosshead brass and the top end of the connecting rod. Pounding might be overcome in many engines if the rods were put in line. It is sometimes necessary to scrape the

babbitt metal of the bearings in order to get a true alinement, but, no matter what is called for, the engineer can rest assured that continual trouble will ensue as long as the connecting rod is out of alinement.

On a 12,000-horsepower quadruple expansion engine the writer sailed with he spent many a hard day in tropical climates scraping the bearings to put the high pressure rod in line; in fact, on every available opportunity the chief had him on this job, but eventually success and comfort were the reward.

If the rod is found to be in line, turn the engine back until the crank is on its exact top center, and take off the guide plate and remove the cap bolts from the top half of the connecting rod bearing; then raise the lower bearing out of the crank pit until the bolts have just entered the holes, then carefully place two or three pieces of lead wire circumferentially at equal intervals along the surface as described for the main bearing; then pull the bearing or cap up into position and tighten the nuts to their previously located marks. Again slacken back the nuts and lower the bottom half of the bearing just so the leads can be removed. If they are the right thickness, clean the bearing thoroughly and pour a little clean oil on the surface; then heave up and pull the nuts solidly up to their marks, using a hammer on the wrench and being certain as before that the bearing is up solid on the liners. The intermediate pressure and low pressure engines are adjusted in turn in the same manner as described.

The foregoing is intended as a mere outline on the subject of the adjustment of marine engine bearings, all of which is familiar to seagoing engineers; but there are three important points to be remembered which should be emphasized, namely, before turning the engine see that the propeller is clear; that the guide plate is off and that all other obstructions are removed.

Fire on Motorship Sebastian Not Caused by Hot Exhaust Pipe

With reference to the article on page 137 of the March issue, written by Ensign Z. W. Wickes, entitled "Precaution Against a Fire on Diesel-Engined Ship," apparently Ensign Wickes is not thoroughly familiar with the case of the fire on board motor vessel *Sebastian,* to which he refers.

In the first place, he states that the fuel oil came in contact with the hot exhaust pipe of the main engine, which ignited the oil. But I would like to make it clear that the pouring of fuel oil on the hot exhaust pipes would not cause flames, and, furthermore, the exhaust pipes in question were properly lagged.

After making careful investigation, I have come to the conclusion that there was some foul play in connection with the fire. Perhaps a few details as to the fire will be of interest:

It appears that the chief engineer, when in his cabin, noticed by the sound that one of the engines had stopped and that the other was slowing down. So he quickly went below and noticed that the fuel oil had started to overflow from the filter, which is mounted on a grating over the engines, the fuel supply bottles that are suspended on a balance having run dry (probably due to a chokage between the filter and the reservoir supply bottles). The fuel supply bottles, running dry, of course, stopped and slowed down the engines respectively. Suddenly there was a tremendous flash of flame and the entire engine room was on fire, the fire instantly spreading right across in a big blaze.

Now, the engine exhaust pipes and the short extensions to each cylinder head were lagged with asbestos, with the exception of three expansion joints on the exhaust pipes and the flanges connecting the extensions to the cylinders.

This fully indicates that the fire had absolutely nothing to do with the Diesel engines, because the exhaust temperature could not possibly have been sufficiently hot to ignite fuel oil, and nowhere could there have been an exposed flame from the engines. To us it seems that there must have been some enemy plot that was arranged either before the ship left port or while the ship was at sea. Probably some highly inflammable chemical or gasoline (petrol) was mixed with the fuel oil before or after it was put in the bunkers. That the fire should have extended all over the engine room adds to the mystery.

"The remarkable thing," said the chief engineer, "was the entire suddenness and extent of the blaze."

The mean temperature of the exhaust gases of the *Sebastian's* engines under normal full load conditions is about 700 degrees F., whereas when the accident occurred one engine had stopped, owing to a stoppage of the fuel supply, and the other had slowed down, so that the exhaust gas temperature must have been very low when the fire started. There was no electrical sparking device on the engines to start a fire.

Mr. Arthur West, of the Bethlehem Steel Company, since has made some tests with a high powered gas engine at their works. While the engine was running at a big overload and with high exhaust temperature, fuel oil of 33 degrees Baume at 75 degrees F. (solar oil was the residual fuel used by the *Sebastian*) was poured over the naked, uncooled exhaust pipes; close to the cylinders, but under no circumstances could they produce a flame, just a smoke, that's all! Kerosene (paraffin) then was tried, with exactly the same results.

Now, this test was very severe, as it was made with an engine running at an overload and without an asbestos-covered or water cooled exhaust pipe, so it is obvious that the residual-oil fuel known as "solar-oil," running on to the exhaust pipe, or any other part of the *Sebastian's* engines, could not have caused a fire, and so supports our theory of a plot. No engineer of common sense would consequently blame the Diesel principle as the cause of the fire.

T. Orchard Lisle.

New York.

Steam Tables for Condenser Work

The Wheeler Condenser & Engineering Company, Carteret, N. J., announce that the fourth edition of their handbook entitled "Steam Tables for Condenser Work" is now off the press, making a total of 20,000 copies.

One reason why this handbook has met with such success is that the pressures below atmosphere are expressed in inches of mercury referred to a 30-inch barometer. Another is that it is complete. It includes a discussion of the mercury column, the errors in such measurements, and constants for their correction.

A complimentary copy of the handbook will be furnished on request to those in responsible positions who are not yet provided with a copy and who deal with steam and its many problems.

Trams get lost, bent or broken. It is a mighty good plan to center punch the length of trams on some part of the engine and label it by stamping what they are for between the punch marks, as these records cannot get lost and are always correct.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

CONDUCTED BY H. A. EVERETT*

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

There will appear in this column from time to time questions which have been asked by the Board of Steamboat Inspectors in the various examinations for engineers' licenses conducted by them. Such questions will be denoted by an asterisk (*) placed before the number if from examination for grade of chief, and by a dagger (†) if from examination for other grades.

Boiler Proportions

Q. (959).—Given an order for a Scotch boiler of the following particulars: Diameter, 12 feet 6 inches; length, 17 feet; double ended; six furnaces; 180 pounds steam pressure, how do you determine the diameter of the furnaces, the height of the waterline and top row of tubes above the center of the boiler, the depth of the combustion chamber, front to back, with furnace openings from one or both ends of the boiler, the proportions of the tube area to the furnace diameter, as, for example, how many 3-inch tubes should be used with a 36-inch furnace; also the area and spacing of staytubes? How much heating surface should be provided in a boiler of this size?

A. (959).—The following represents good practice for a unit of the dimensions mentioned, but this is a poor way to design a boiler:

a. Diameter of furnaces for 180 pounds pressure = 36 inches. Thickness of furnaces for 180 pounds pressure = 15/32.

b. Water level should be approximately 3 feet above centerline. Top row of tubes should be approximately 70 percent of diameter of boiler above bottom of shell.

c. Depth of combustion chamber about 26 inches.

d. Tube area is dependent upon the length of boiler and the heating surface required. The number of tubes for this specific unit would be about 574 as a maximum.

Total area of cross-section of all stay tubes = 1,500 square inches (about 3/8 of total number of tubes should be stay tubes).

Tubes spaced vertically 4 inches between centers and horizontally 4 inches between centers.

Total heating surface, about 3,200 square feet.

Making Up With Salt Feed

Q. (962).—Why was blowing off and making up with salt feed admissible in marine practice years ago, while now it is inadmissible?

A. (962).—In the early days of marine engineering the pressure and temperature of the steam were low and the jet condenser the one in general use. The boiler feed was taken from the condenser, and, consequently, was practically the same in salinity as sea water. The density of the water in the boiler was kept down by frequent blowdowns, and usually was between 1.5/32ds and 2/32ds. However, the scale-forming salts, such as magnesium and calcium sulphates, are not thrown completely out of solution until the temperature of the solution is about 286 degrees F., which corresponds to a pressure of 39.3 pounds per square inch, gage. A small amount of scale was formed, nevertheless, before this temperature was reached.

As pressures were used above 39.3 pounds per square inch, the formation of scale was rapidly increased. Blowing off to reduce to the desired density at pressures above 40 pounds required such a large amount of extra feed, and consequently the formation immediately of considerable quantities of scale, because the scale-forming salts are all deposited. Due to this blowing off, a large amount of heat is also lost. It was found necessary because of the above reasons to abandon the use of salt feed and the jet condenser.

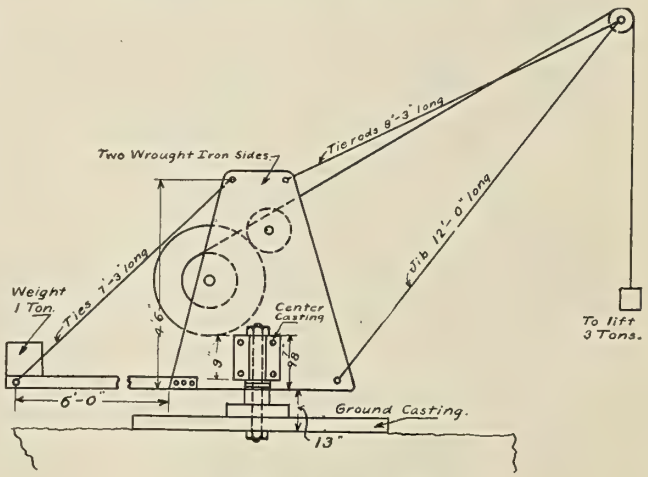
At present the feed water is made fresh by the use of an evaporating system and consequently the formation of scale is prevented. As it is difficult to keep condenser tubes packed perfectly tight, the cooling water, which is salt water, will pass into the boiler (the quantity depending, of course, upon the leaks). The scale formation, however, is inconsiderable and can be prevented by the proper use of soda ash.

Consequently, as the prevention of scale-forming salts passing to the boiler is accomplished by the use of distilled water, it should not be necessary to blow off very frequently.

Calculations for 3-Ton Revolving Hand Crane

Q. (956).—The sketch shows a small revolving hand crane. The center pin is tight in the center casting and revolves by a collar on balls in the ground casting. Please show how to find the bending moments and the diameter of the pin.

A. (956).—The data are not quite complete, as the distances of the points of attachment of the jib arms from the center line of the pin are not given; but, estimating



Sketch of Hand Crane

these and plotting the structure to scale, I get the perpendicular distance from the line of action of the load to the pin to be 8.08 feet, and from the counterweight to the pin 7.5 feet. Using these, the overturning moment due to the load is 3 × 8.08 = 24.22 foot-tons. The righting moment due to the counterweight is 1 × 7.5 = 7.5 foot-tons. Therefore, the net overturning moment is 24.24 — 7.5 = 16.74 foot-tons.

This is the bending moment acting on the pin between the base casting and the upper body, tending to bend or

*Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

break it. The stress due to this bending is expressed by the formula $f = \frac{MY}{I}$. Where

f is the fiber stress.
M the bending moment.
Y the distance of the most strained fiber from the neutral axis of the section (equal to the radius of the pin in this case).
I is the moment of inertia of the section.

All expressed in units of inches or pounds.

Since the diameter of the pin is not known, we must assign an allowable fiber stress in order to permit solution for diameter. Taking 10,000 pounds per square inch as an allowable working stress, the formula becomes

$$10{,}000 = \frac{MY}{I},$$

and substituting the values of

$$Y = \frac{\text{Diameter}}{2}, \text{ and } I = 0.0491\ D^4, \text{ we get } \frac{I}{Y} = \frac{1}{0.0982\ D^3},$$

and, substituting this value in our original equation,

$$D^3 = \frac{M}{982}.$$

Substituting the value of the bending moment obtained at first of 16.74 foot-tons.

$$\text{Diameter}^3 = \frac{16.74 \times 12 \times 2{,}240}{982} = 458 \text{ inches.}$$

Diameter = 7.68, or 7⅝ inches approximate.

This does not take account of the direct compressive stress due to the total load of 4 tons, which should be added to the original stress of 10,000 pounds to obtain the final stress in compression (10,000 + 194 = 10,194 pounds, and subtracted to obtain the final stress in tension). (10,000 — 194 = 9,806 pounds.) It is, however, small in this case and may be neglected, but should always be figured. For allowable fiber stress of 12,000 and 15,000 pounds per square inch we would get 7¼ inches and 6¾, respectively, for the approximate diameters.

Parts of a Ship Requiring Calking

Q. (963).—I would like to know what parts of a ship are calked and what rivets are calked; also, where the felt packing is placed in regards to watertight and non-watertight parts, etc.?

A. (963).—A certain degree of watertightness is always obtained by spacing the rivets sufficiently close together. Since it is not always desirous to adopt a very close spacing of rivets, calking is resorted to. Briefly, those parts of a ship that are calked are the following: Scarfs of the bar keel, shell plating, tank top, floors where double bottom is divided into various compartments, bulkheads bounding bars, steel decks which are exposed to the weather, plating around watertight doors, bounding bars around watertight hatches and several other places of minor importance. The forward collision bulkhead is calked on the after side and the after collision bulkhead is calked on the forward side. In the case of decks uncovered by erections, watertightness against shell is secured by calking gunwale bar against shell and against deck. Angle clips connecting a non-watertight member to a watertight member should be calked all around its edge.

In general, where the plating is very thin, where watertightness is of importance, and especially where the joints are liable to great strains, as in the outer shell of torpedo boats, watertightness is obtained by the use of felt packing. Also used between doubling plates, since it is difficult, especially on the curved surface of the outer shell, to obtain a perfect fit between the plates. The use of soft packing as a substitute for calking should be confined to joints which cannot be readily or properly calked, as in watertight collar angles, tank divisions, margin plate lugs, bars on tank top, etc.

Rivets are calked only where watertightness is of particular importance or in oiltight work, and should in such case be countersunk on the point, although where necessary heads and points of rivets are calked.

Inclined Propeller Shaft

Q. (966).—Is a propeller shaft ever inclined upwards toward the stern of a ship, or is the shaft always parallel to the base line or inclined downward? What advantage, if any, is gained by inclining a shaft? I had a case the other day of having to change the stern frame casting to give more clearance between it and the propeller, and it occurred to me the shaft could be raised a few inches aft to avoid this change. I have never seen a shaft inclined up, so would like your opinion. Does inclining a shaft affect the thrust?

A. (966).—The centerline of the shaft may be parallel to the keel or inclined a slight amount either down or up as you proceed aft, the latter being the most common. The location of the centerline at the sternpost is usually determined by the diameter of the propeller, and for low revolution propellers is placed as low as the diameter will permit. The forward end is fixed by the bedplate and engine foundation, and it is usually preferable to keep the foundation low, even though the shaft incline upward slightly as we proceed aft. With turbines having large rotors the forward end may be slightly higher than the after end. The thrust is affected only as the cosine of the angle between the direction of motion of the ship and the axis of the shaft, and is inappreciable for angles up to 5 degrees (cosine 5 degrees = .996).

Highest Speed Attained by Hydroplanes

Q. (968).—We have had considerable discussion lately on a point which we hope you can settle for us. The question has been raised whether a water-supported boat, hydroplane, or other vehicle has been driven at a greater speed by means of a water propeller or by an air propeller. Undoubtedly, the greatest speed has been obtained with a contrivance embodying hydroplane principle. By hydroplane I mean a water plane without air supporting wings.

It is my remembrance that the highest speed obtained by an ordinary racing boat employing the hydroplane principle, and driven from water, is in the neighborhood of 75 miles per hour. Could you advise me definitely just what this record is and if it has been bettered by a hydroplane from the air? I believe there have been several such machines constructed without the body of a boat, which is customary with ordinary racers, and that these types will not stay on the surface unless in motion at or above a certain speed. Some of these have made very high speeds, and I hope you are in a position to advise me authentically just what is the highest speed obtained by this means?

A. (968).—The national one-mile motorboat championship race, Minneapolis, Minn., August 28, 1917, was won by *Miss Detroit II*, of the Detroit Power Boat Association, the only starter. Average speed for six one-mile dashes against time, 61.72 miles per hour. The *Whip-Po-Will*, a 28-foot hydroplane, owned by A. L. Judson, A. P. B. A., averaged 69.39 miles per hour in six one-mile time trials on Lake George, November 6, and covered one mile in 51.55 seconds, or at the rate of 70.15 miles per hour in its best dash. I believe air propeller driven gliders in France have gone to 90 miles an hour and higher, but have no definite recent figures.

Springs

Q. (969).—I am in need of a formula to get immediate practical results on springs and the relation between long and short beams and shafts to figure out their strengths? M. B.

A. (961).—The general discussion of springs is given in any good book on applied mechanics, or Kent's mechanical engineers' handbook, pages 417-424, or Mark's mechanical engineers' handbook, pages 425-432. If you will send on data for a specific problem I will be glad to indicate the solution and make the computation.

Shipbuilding and General Marine News

Contracts for New Ships—Shipyard Improvements—Engineering Projects—Improved Appliances—Personal Items

182 STEEL SHIPS LAUNCHED SINCE BEGINNING OF CAMPAIGN

Eighty-five Requisitioned Vessels Finished and Turned Over to Shipping Board

A total of 182 steel vessels have been launched in American shipyards since the beginning of the shipbuilding campaign, according to a statement made public by the Shipping Board on April 2. Along with the statement of launchings the board gave out these additional facts:

REQUISITIONED SHIPS COMPLETED

Eighty-five requisitioned vessels have been finished and turned over to the Shipping Board.

Fifteen requisitioned ships have been reconveyed to their former owners before completion. These fifteen are now in service.

Three contract steel vessels have been completed and turned over to the Shipping Board and are now in service.

One hundred and seventy requisitioned vessels have been launched.

Twelve contract steel vessels have been launched, nine of them now being fitted out. The twelve includes the three completed and delivered contract vessels.

TONNAGE OF FINISHED VESSELS

The total tonnage of the 170 requisitioned ships launched is 1,173,217 tons. The tonnage of the twelve contract vessels is 99,200 tons. The three delivered contract vessels aggregate 26,400 tons, and the nine uncompleted contract ships 72,800.

All the steel contract launchings and all the wood ship launchings have been from yards which were built from the ground up. More favorable weather conditions have enabled the yards on the Pacific Coast to make more speed than those on the Atlantic.

Plan for the Mobilization of Lake Shipping Resources

When the Government took from the Great Lakes all vessels that were available for ocean traffic, the Lake Carriers' Association got together and decided to make up for the loss through a concerted effort toward getting a greater efficiency out of the remaining fleet.

Following that action, committees representing pig iron, iron ore, coal industries and railroads agreed that there should be the closest possible co-ordination and co-operation between these interests and the bulk freight vessels, and plans were formulated for an iron ore and coal exchange, under the supervision and direction of an executive committee of four, one member to represent each the iron ore, coal shippers, railroad and the ships.

This committee is to have power to regulate the assembling movement and distribution of bulk freight on the Great Lakes as will best serve the public interest, and in order to co-operate to the fullest extent possible in this movement it was considered necessary that the mobilization committee shall have full charge of the direction of the bulk freight vessels.

New York State Barge Canal Under Railroad Administration Control

Director-General McAdoo has taken over the Erie & New York State Barge Canal system for the Railroad Administration, and has ordered that a fleet of barges be constructed immediately under the direction of G. A. Tomlinson, Duluth, Minn.

These barges will be of the most approved type, and will be operated as a part of the general railroad and waterways transportation system of the country. It is planned to order several hundred barges immediately, to be built on the Great Lakes.

The cost of each barge will be in the neighborhood of $60,000.

SHIPYARD DRAFT EXCEEDED

Approximately 260,000 Men Enrolled in Public Service Reserve

Through its Public Service Reserve, the United States Employment service has registered approximately 260,000 mechanics to meet future needs of the shipyards or calls for men of special trades, the Department of Labor announces. This number exceeds the goal of a quarter of a million which was set at the start of the drive a month ago, and all States are continuing enrollments.

The Federal Employment Service states that this reserve will be drawn upon gradually, since large numbers of men are not in immediate demand by the yards, and the unemployed workers applying at branch offices of the Employment Service will first be used. As ship construction progresses, however, the reserve will be called upon to furnish men in increasing numbers.

Shipbuilders Send Ambulance to France

The 4,600 workmen of the James Shewan & Sons Dry Dock & Repair Yards, Brooklyn, N. Y., have presented the American Red Cross Society with a fully equipped ambulance, costing $5,000, ready to be shipped to France.

GOVERNMENT PLANT FOR BUILDING CONCRETE SHIPS PLANNED

$50,000,000 Appropriation Approved by the President

President Wilson has approved an estimate of appropriations for $50,000,000 for the acquisition or establishment of plants suitable for concrete shipbuilding, or "for the enlargement or extension of such plants as are now or may be hereafter acquired or established, and for the cost of construction, purchasing, requisitioning, or otherwise acquiring such concrete ships."

THREE LAUNCHING WAYS PLANNED

The Shipping Board had already planned to construct three launching ways for three 3,500-ton concrete vessels, and if these proved to be successful the board had then intended to go to the 7,500-ton type. But with this large appropriation in sight, Chairman Hurley said that rush work will be immediately begun at the projected plant in Wilmington, N. C.

New Shipyards and Extensions Planned

The Columbia River Shipbuilding Corporation, Portland, Ore., H. A. Killan, purchasing agent, is planning to install two additional ways, giving it an output of eighteen wooden vessels annually.

The Southwestern Shipbuilding Company has been organized in Los Angeles, Cal. Arthur C. Hurt, E. A. Mills, J. D. Flora and John C. Cain, Los Angeles, are the incorporators.

Charles B. Stanford, Charles H. Hamlin and others are organizing a shipbuilding company at Bangor, Me., to revive shipbuilding in the Statson yard at Brewer, Me.

The Maritime Engineering Corporation has been organized in New York City and has acquired a site on Goat Island, Elizabeth City, N. C. It plans the immediate construction of a yard to build steel vessels. Russell B. Smith, 50 East 42d St., New York, is president.

It is reported that the American Shipbuilding Company, E. W. Cook, 11 Broadway, New York, purchasing agent, will establish a yard at Quincy, Mass., for building wooden ships.

The Milton Shipbuilding Company has been organized at Yarmouth, N. S. Armand Deveaux is among those interested.

The Fraser Shipbuilding Company has been organized at New Westminster, B. C., to build wooden, steel and concrete ships.

The New York Shipbuilding Corporation, Camden, N. J., L. G. Buckwalter, purchasing agent, is building extensions

to its yard in order to double its present capacity.

Doullut & Williams, New Orleans, La., are planning to build a shipyard on the proposed municipal industrial canal.

The Carolina Shipbuilding Company has been organized at Charleston, S. C., and is represented by Philip H. Gadsden.

The Gulf Shipbuilding Company has been incorporated at Pascagoula, Miss., by A. F. Dantzler, H. H. Colle and B. G. Boag.

It is reported that the National Shipbuilding Company, Orange, Tex., is planning to build a shipyard at New Orleans.

The Concrete Ship & Barge Corporation, recently organized in New York City, is planning a shipyard at Biloxi, Miss.

The Tampa Dock Company, Tampa, Fla., J. L. McGucken, purchasing agent, is planning extensive additions to its yard.

New Yard at Alexandria

Fred T. Ley & Company, Inc., Springfield, Mass., have received the contract for building the American Shipbuilding Company's yard at Alexandria, Va. The purchasing agent of the American Shipbuilding Company is E. W. Cook, 11 Broadway, New York. It is reported that the company has received contracts to build twelve steel steamships for the United States Shipping Board.

The Inter-Ocean Barge & Transport Company has been organized in Seattle, Wash., where it is the intention of the company to build concrete ships. It is reported that the company has already received a contract from the United States Shipping Board to build several concrete ships.

The Macrenaris Shipbuilding Company has been organized at Tarpon Springs, Fla., to build coasting steamers. E. Macrenaris is manager.

The American Shipbuilding Company, Brunswick, Ga., purcahsing agent, E. W. Cook, 11 Broadway, New York, has increased its capital stock from $50,000 to $5,000,000 and is reported to be planning extensive additions to provide for new Government contracts for steel steamships.

To Build Concrete Ships

The Fougner Steelconcrete Shipbuilding Company, N. K. Fougner, president, 18 East 41st St., New York, main office, Christiania, Norway, is planning to build a yard for the construction of steel-concrete steamships.

The Newcomb Life Boat Company, Newport News, Va., will build a marine railway of the Crandall type, with a capacity of 5,000 tons.

The Inter-Ocean Barge & Transport Company has been organized at Seattle, Wash., and is planning the erection of a plant for the construction of concrete ships.

The Florence Shipbuilding Company has been incorporated, with headquarters at Eugene, Ore., and will build wooden ships.

The Federal Shipbuilding Company, Robert McGregor, general manager, a subsidiary of the United States Steel Corporation, 71 Broadway, New York, has purchased 93 acres adjoining its plant at Kearny, N. J., with the intention of making large additions.

The Murnan Shipbuilding Corporation, H. C. Murnan, general manager, Mobile, Ala., has purchased a tract on the east shore of the Mobile River and is planning extensive additions to its yard, where steel ships will be built.

The United States Shipping Board has selected Charleston, S. C., as the site of the two aditional shipyards to be constructed on the South Atlantic coast.

The Shell Banks Shipbuilding Company, Mobile, Ala., Varian C. Scott, president, John Jones, vice-president, Ernest F. Ladd, treasurer, Edwin Scott, secretary, succeeds the Scott Shipbuilding Company. The company is planning to build schooners and other wooden ships.

The Barnes & Tibbitts Shipbuilding & Dry Dock Company, Alameda, Cal., has been organized with the intention of building ships for the United States Government.

O. A. Johansen, president of the Western Shipbuilding Company, Oakland, Cal., which will specialize on wooden vessels, states that the company has already received contracts totaling more than $4,000,000.

The American Shipbuilding & Transportation Company, Boston, Mass., is planning the construction of a shipyard at Quincy, Mass., with five launching ways for wooden and concrete ships.

The Darien Shipbuilding Company has been organized in Darien, Ga., to construct wooden ships. The officers are: Robert Manson, president; F. H. McFarland, vice-president; R. J. Downey, secretary and treasurer, and T. S. Lawrence, general manager.

Norway Loses 745 Ships Valued at $330,000,000

Norway's shipping losses through German submarine ruthlessness and other war operations continue to grow. During March nineteen ships of 34,994 tons were lost. The total value of Norway's shipping losses for March in round figures is almost $10,500,000.

With the March sinkings Norway's losses since the beginning of the war amount to 745 vessels, with an aggregate tonnage of 1,101,815, valued at $330,000,000. In addition, fifty-three vessels are missing, two-thirds of which are set down as war losses.

Norwegian seamen to the number of 986 have lost their lives in the sinkings, while on the fifty-three missing vessels there were 700 men.

How the French Settle Ship Labor Disputes

Publicity is the sole means employed by the French Government in enforcing decisions in the case of disputes between seamen and employees in the merchant marine.

According to advices just received by the Bureau of Labor Statistics of the Department of Labor, the port wardens of the various ports are required to offer their services as conciliators in all disputes involving twenty or more men. In case of failure of such arbitration the matter is referred to a superior committee of 12, made up of equal numbers representing employers and employees. Two members must be magistrates when the board is ready to decide a case; its decisions are announced by means of posters displayed at the entrances to the offices of the port. No penalties for non-compliance are provided for.

SPECIAL TRAINS TO BRING LUMBER FROM PACIFIC STATES

Atlantic Coast Shipyards to Be Supplied in One-Fifth Ordinary Time

Special trains bringing huge fir logs from the Pacific lumber States will speed up wooden ship construction this month along the Atlantic and Gulf coasts. An arrangement, entered into by Chairman Hurley, of the Shipping Board, and Director General McAdoo, of the Railways, will rush 50,000,000 feet of Douglas fir across the country in one-fifth of the time usually required for the journey.

Eighteen wooden ships, totaling 63,000 tons, are to leave their ways before May 1. The transportational preference will expedite about half of this total into the water. Upwards of 20,000 additional tons of wooden ships are also due to be launched this month under private contracts.

Supply of Yellow Pine

The rush shipments of heavy firs are an emergency measure put in effect to bring the Atlantic and Gulf plants up to the programme set for them some time ago by Chairman Hurley. Special surveys of the pine regions of the South, now virtually completed, promise in another month to supply from that part of the country all the heavy yellow pine that will be required by the Gulf and Atlantic yards. Changes in specifications for wood ships hereafter to be built in the South and East will make the Southern pine thoroughly satisfactory. These ships will average about 4,000 tons.

Of the 18 ships in sight May 1, barring unavoidable setbacks, the schedule made public by Chairman Hurley shows the output of the East and South breaking about even for the first time with the West. Nearly all the Eastern and Southern yards making this achievement date back only to last year in their organization and equipment. Wood shipbuilding was practically obsolete along the Atlantic and Gulf when they got under way, and they were obliged to learn the game from the ground up. Nearly 75 percent of their workmen were formerly house carpenters.

Indicate Records Will Be Broken

All reports from these plants to Chairman Hurley indicate record-breaking production for the remainder of the year. The established Pacific Coast yards having readily accessible lumber report their progress up to schedule, with every likelihood of attaining greater rapidity.

A compilation prepared by the statistical department of the Shipping Board shows the amount of work which Oregon has been doing and expects to do in the way of shipbuilding. Up to date 127 vessels have been built, contracted for and requisitioned in that State.

United States Gets Japanese Ships in Exchange for Steel

Arrangements have now been made, as a result of the negotiations between the United States and Japanese shipbuilders, for the purchase of twelve Japanese

ships of approximately 100,000 tons deadweight capacity, which will be added to the fleet of the United States Shipping Board within the next few months. All of the vessels are large, modern steamers of 6,000 tons or over, with one exception, and none over two years old. Some, indeed, are still awaiting completion. Deliveries of the ships at American ports are to begin not later than May and to be finished in September, a progressively higher price per ton to be paid according to the month of delivery as a premium on early deliveries.

Steel for Japanese Builders

In return for the sale of the ships the War Trade Board has agreed to deliver to the Japanese shipbuilders a corresponding amount of steel for shipbuilding ton for ton against delivery of the ships.

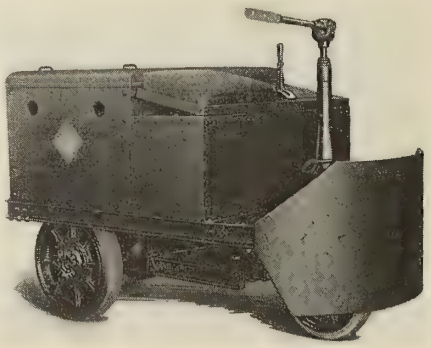
Further negotiations are in progress to secure from Japanese shipbuilders 200,000 additional tons of new construction, the ships to be built in return for new steel placed at the disposal of the builders by the War Trade Board.

Arrangement of Hoisting Crane on Elwell-Parker Truck

Triple Utility Industrial Truck

In order to extend crane services beyond the reach of present travelers to more remote parts of the storage yard the crane-equipped electric industrial truck, as manufactured by the Elwell-Parker Electric Company, of Cleveland, is found useful. It consists of a substantial crane carried on a ball bearing pedestal, the boom of which may be swung to right or left 28 inches over the side of the truck. The lifting capacity is 1,000 pounds at maximum outreach.

The hoisting mechanism consists of a totally enclosed reduction and hoist drum with special Elwell-Parker low-voltage reversing motor directly attached. This motor receives power from the same battery that furnishes current to the separate propelling motor. The hoist controller is located at the rear of the motor next to the operator.



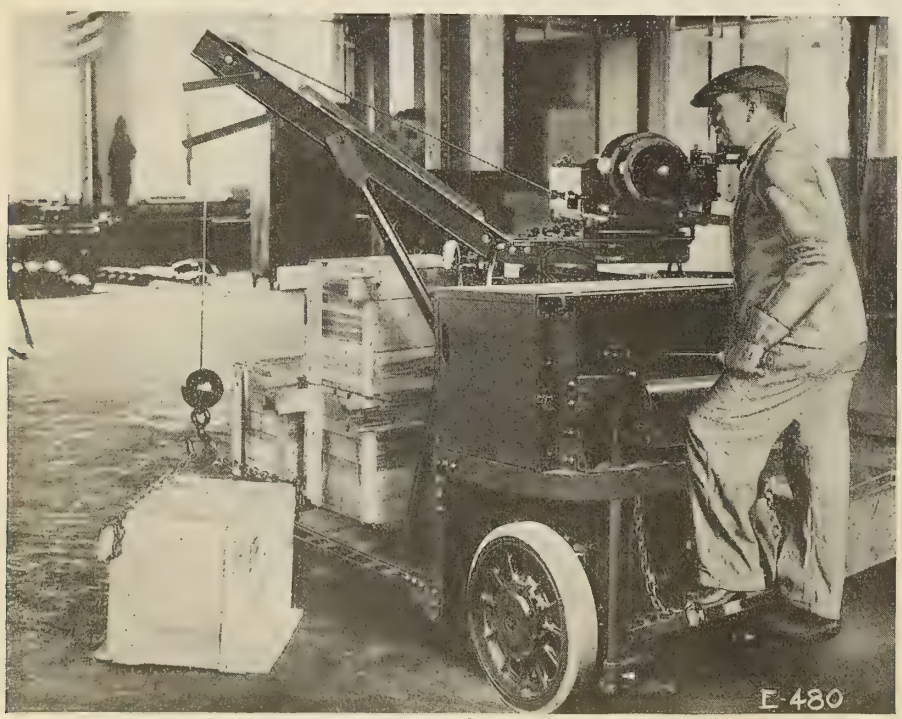
Three-Wheel Elwell-Parker Tractor

The hoisting unit is mounted on and revolves with the crane boom, counterbalancing the load to some degree. A special trip switch opens the motor circuit when the hook reaches a certain predetermined height. A ball weight facilitates lowering the hook when empty.

This crane is mounted on a standard four-wheel-steer, single-reduction, direct-connected, worm-driven truck, with large-size drive wheels 21½ inches by 3½ inches and 15 inches by 3½ inches trailing wheels, which give a platform height of 17 inches. Ample clearances are thus provided throughout the length of the truck. The loading platform is 92 inches by 40 inches and provides ample space for a 4,000-pound load, which is the capacity.

The handling of pieces of more than two hundred pounds usually requires more than man power. The suitability of a revolving power crane on a power truck to perform this work is unquestioned. It may be used to take boxes, castings or barrels from a warehouse or car floor, load them directly onto its own carrying platform or swing the pieces through an arc of 180 degrees and deposit them on a trailer waiting on the opposite side. If desired, the crane truck may be used as a tractor to draw the string of trailers it previously loaded. It, therefore, becomes a triple-utility self-loader, carrier or light tractor—a most valuable general utility tool for any warehouse or shipyard. Two men with this will do the work of ten, it is claimed.

Since traction or adhesion depends wholly upon the weight and the ability of the motor to revolve the wheels under that weight, so long as the current supply holds out any electric industrial carrying truck may be used as a light tractor. Elwell-Parker trucks and tractors are equipped with motors which will take care of all the power in the battery as fast as determined by traction. A heavy duty type four-wheel-steer tractor has been found especially suitable for most freight terminal work. The more important war terminals are being equipped with that type.

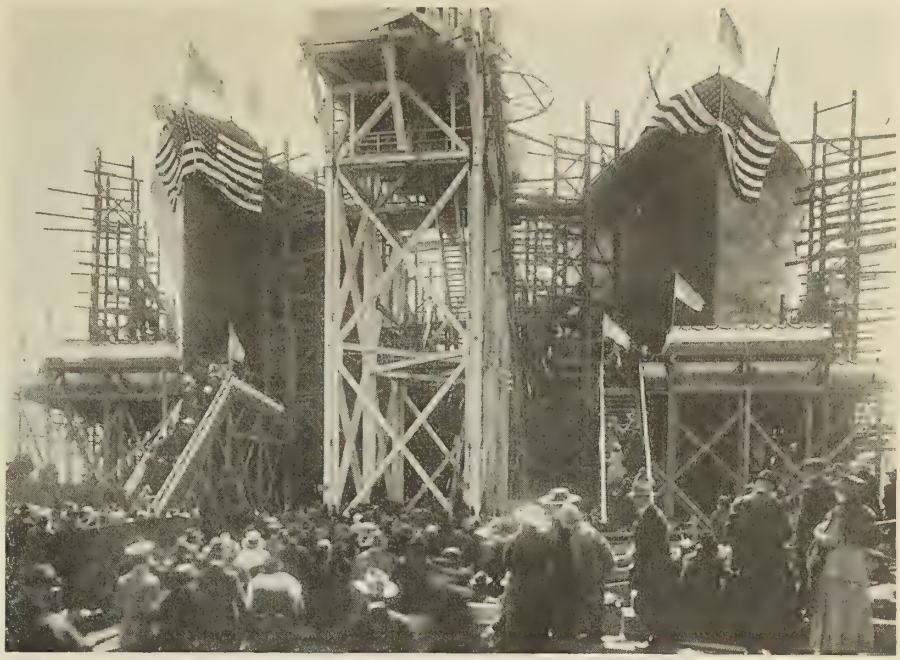


Hoisting Mechanism on Elwell-Parker Industrial Truck

To meet a certain demand for a tractor to fit in between the carrier truck and heavy duty tractor, a three wheeled tractor has been designed and is giving excellent service in small package freight houses. Its battery capacity and weight over drivers is midway between that of the truck and tractor. It is a three wheeler, and instead of turning all four wheels the front turns at an angle equivalent to the sum of that on the front and rear of a heavy duty tractor.

The tractor is built for medium service, occupying a position about halfway between an ordinary electric truck and a heavy duty tractor. One of the most distinctive features of this tractor is that it has a single front wheel. It is steered by a hand wheel or a hinged right and left lever. When the wheel steer is used the control lever is located on the left of the column. When the lever steer is used a control lever is provided at the side of the operator's seat, as shown. The steering wheel is carried on roller bearings in a heavy steel fork, spring supported, turning on large ball bearings in the steering column base. The seat operates as a circuit breaker, which closes when the operator's weight presses the spring, but only when the controller is in off position. It cannot be started from the floor.

The tractor has solid wheels and solid rubber tires. The normal drawbar pull is 300 pounds and 850 pounds maximum. The speed with no load is 625 feet per minute. Its length is 70 inches and width 41 inches. The outside turning radius is less than the length of the tractor.



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Twin Launching of S. S. *Shintaka* and S. S. *Aniwa* at Oakland, Cal.

A New Tool That Fills a Long-Felt Want

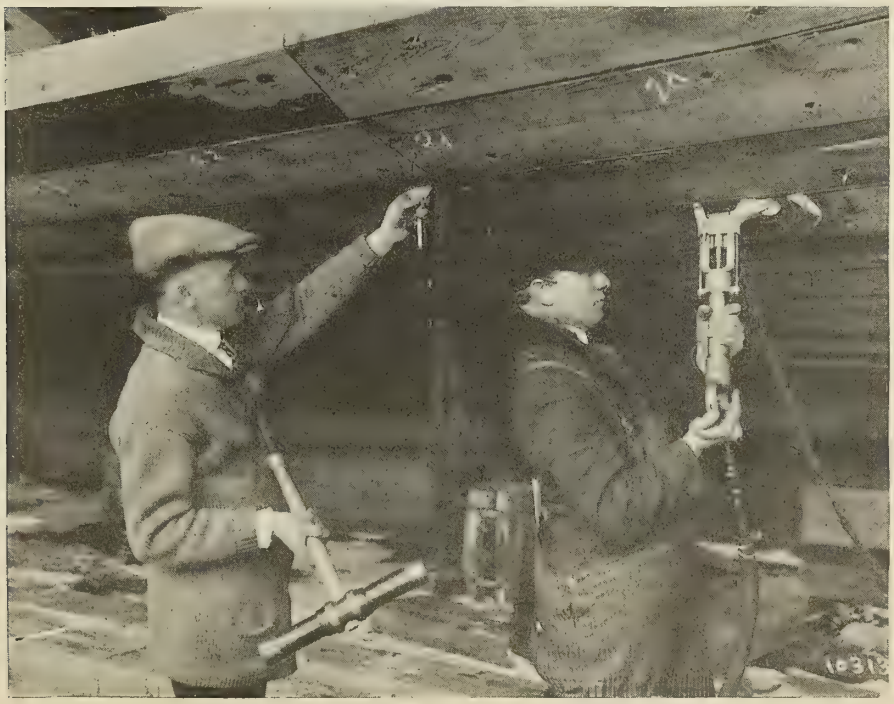
Shipbuilders will be interested to learn of the perfection of a practical pneumatic calking machine. This tool, known as the "Little David" calking machine, is being placed on the market by the Ingersoll-Rand Company, 11 Broadway, New York, who report an enthusiastic reception wherever it has been introduced.

The pneumatic calking machine weighs but 13½ pounds, and observed performances show that it can be easily handled and operated in any position. It automatically tacks either machine or hand-spun oakum in side or bottom seams to any depth required for final horsing. On deck planking it will do the horsing. Its working speed is about 1,500 tacks per minute, either coiling or running the oakum straight.

The "Little David" calking machine is controlled by a trigger similar to a light scaling hammer. It differs, however, from the usual hammer in that the piston has an extended rod fitted with a thin calking blade. This, being a reciprocating iron with positive pull back, has no tendency to bind. The calking iron travels in guides, which prevent it from turning, the whole being fitted with springs, so that the workman can vary the penetration of the calking iron with the varying depth of the seam. A unique device automatically feeds the oakum with each movement of the calking blade. Guide wheels run in the seam being calked and keep the threading iron lined up. The tool operates with negligible vibration, and its design is such that it follows without effort on the part of the workman; in fact, machine calking is so simple that ordinary workmen can do highly efficient work.

A demonstration was recently conducted before the United States Shipping Board Emergency Fleet Corporation and the tool was approved by them. The tool measures 22 inches in overall length. The ordinary equipment consists of a calking iron of 1/16-inch thickness, although ⅛-inch iron can be furnished if desired.

This tool should immeasurably increase the speed of wooden shipbuilding, which up to now has been hindered by an inadequate supply of calkers. Any device which will speed up shipbuilding, or, for that matter, any war industry, should be accorded wholehearted support. They place the country and our Allies that much nearer the winning goal.



The Old and New Ways of Calking a Wooden Ship

Dallett Boiler Shell Drill

A motor-driven boiler shell drill, designed to use high-speed steel drills, is manufactured by Thos. H. Dallett Company, Philadelphia, Pa.

This machine consists of two or more drilling heads and two horizontal bars of whatever length may be specified, the lower one being provided with a rack on the under side. This outfit may be incorporated on a housing of the purchaser's own design, in which provision can be made for raising or lowering by

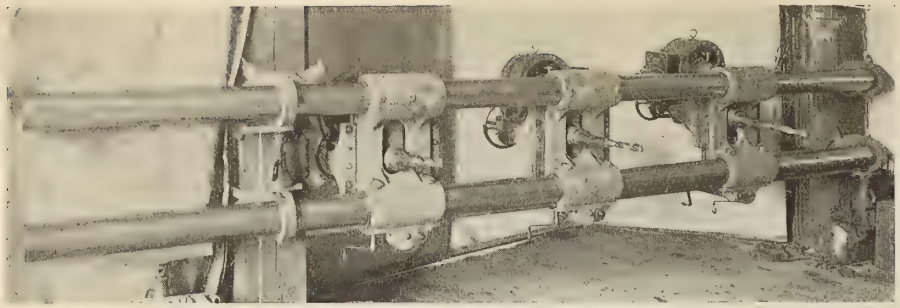


Fig. 1.—Front View of Dallett Boiler Shell Drill

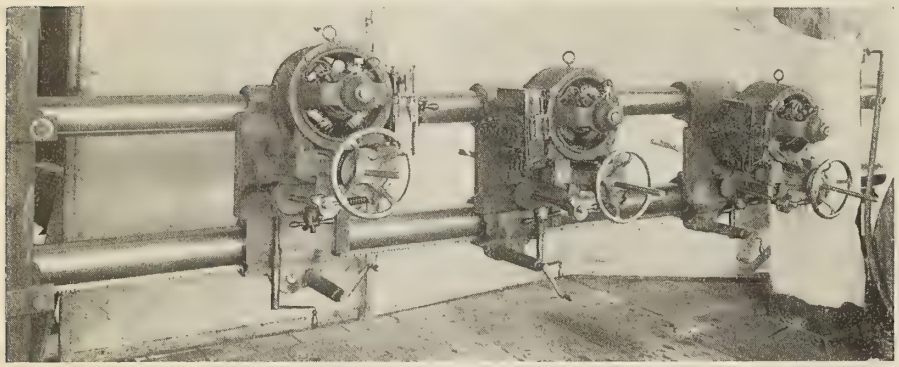


Fig. 2.—Back View, Showing Motors and Control

means of screws connected together at the top by a horizontal shaft and bevel gears, or it may be attached to the structural elements of a building by use of yokes to hold the bars the proper distance apart. The columns of the building may be provided with a series of holes, so that when a shell of a different diameter is being drilled, the whole device can be raised or lowered to the proper place and bolted fast. This latter method answers all purposes in the majority of cases, as the range of the machine within itself is such as to make

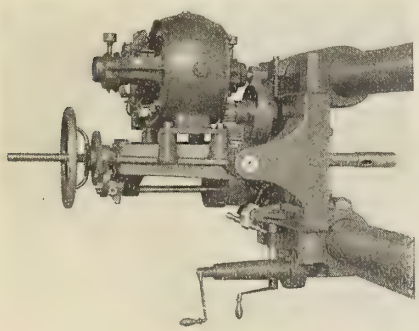


Fig. 3.—Side View

unnecessary the continual raising or lowering of same in actual operation, especially if a number of boilers of the same size are being drilled.

The shell is placed in front of the machine on rollers, and, as each head has a vertical movement and the spindle can be tilted, a hole can always be drilled radially to the center of the boiler. Each drilling head has a vertical adjustment in itself of 6 inches, operated by a crank handle at the bottom, and is moved along the bars by means of a pinion and rack on the under side of the lower bar. The spindle is 2 1/16 inches in diameter and bored for a No. 4 Morse taper. It has a traverse of 16 inches and a range through an arc of 15 degrees, to permit drilling radially, as before mentioned, the latter movement being controlled by the hand wheel, which appears immediately beneath the gear reduction in Fig. 3. The motor pinion and gearing are arranged to give the proper spindle speeds to suit the work in each individual case. There are no bevel gears used in the transmission from the motor shaft to the spindle, spur gears only being used, making a very durable and efficient gear reduction.

The feeding mechanism consists of a feed shaft, crank head, rocker pawl, ratchet wheel, feed nut and feed screw, the thrust of the latter being directly upon the back end of the spindle. The connecting rod between the crank and rocker plate is fitted with a spring, which can be set for any pressure of feed, so that it is impossible for this pressure to be exceeded, as the spring is compressed when the limit is reached and the feed ceases to operate until the pressure is reduced, thus making an automatic relief. Change of feed is effected by shifting the thumb latch around the crank head, and a range of feeds from .005 per revolution of spindle to 1/16 inch can be obtained. This range of feeds covers the entire requirements of drilling in boiler work.

An especially noteworthy feature of the machine is the central position of the spindle not only between the bearing of the drilling heads on the bars, but also between the bars, so that the pressure of the drill head against the work has no tendency to set up torsional or sidewise strains in the drill head or bearings, causing excessive friction of the drill in the hole, rapid deterioration of the drill and undue consumption of power, owing to the spindle being thrown out of alinement, as is the case where a drill spindle is not central of its support.

Each drilling head has individual motor drive, and the machine is entirely self-contained, all adjustments being effected by means of crank handles and hand wheels, no wrenches whatever being required, and the operator has all the adjustments of the head at his command from either side of said head without moving from his position.

The Spray Method of Applying Paint Proves Useful in Shipbuilding

The modern method of applying paint and other surface coatings is by the use of compressed air. This is rapidly superseding the old hand-brush methods, not only by reason of the great saving in time and labor, but also due to the fact that better results are obtained.

The photograph (page 319) shows a painting equipment supplied by the Spray Engineering Company, Boston, Mass., which is compact, portable, and adapted for either shop or field use. It is ready for immediate use, with the exception of attaching the air hose and connecting to the compressed air supply. All the necessary adjustments are quickly made by hand, without the use of tools. Where compressed air is not available, gasoline engine or motor-driven air compressor units are installed.

It is claimed that with this device one unskilled man can do the work of three to twelve skilled painters using hand-brushes, depending upon the nature of the work. Finely finished surfaces, free from streaks and brush marks, are produced, and rough surfaces and those extremely difficult or impossible to reach with a hand-brush are easily and rapidly covered.

It is stated that the gun may be blown free of paint and cleaned without taking apart, and the paint gun may be quickly attached to an extension pole 8 feet 6 inches long, weighing, with the hose, 7½ pounds, for painting surfaces beyond the reach of the operator. By means of interchangeable nose pieces the standard gun is capable of handling all kinds of liquid coatings.

Concrete Ship Launched in Norway

A 600-ton motor-driven concrete boat was launched on March 11 at Moss, Norway. The boat was built by the Fougner Staal-beton Skibsbygnings-Compani at its shipbuilding yards at Moss. It is the first one of its type, special permission having been given for its construction as an experimental boat by the Norwegian Department of Commerce in 1917.

The boat's dimensions are as follows: Length, 145 feet; width, 27 feet 6 inches, and height, 15 feet 9 inches. It is said to have a displacement of 600 tons, and contains four watertight compartments and has a flush deck, slightly raised, the machinery being in the stern. There are two cargo holds with two hatchways, a crane with a 2-ton motor winch having been placed at each hatchway. The windlass, which has been put at the stern, can be operated by hand or by means of chains connected with one of the winches. The machinery consists of one 320-horsepower Bolinder motor, designed to run at 325 revolutions per minute.

INCREASED PAY FOR SHIPYARD WORKERS

Uniform Wage Scale for Atlantic and Gulf Coasts

Decision of Labor Adjustment Board

The Shipbuilding Labor Adjustment Board has handed down its decision in reference to wages, hours of labor and other conditions in the shipyards under its jurisdiction on the North Atlantic coast and Hudson River.

The wage scale announced is the same as that in the Chesapeake and Delaware districts and is an increase over present rates. A uniform wage scale will be put into operation for the entire North Atlantic and Gulf coasts.

Wage Scale

The wage scale prescribed for journeymen, helpers and laborers included the following rates:

Hammer and machine forgers, heavy, $1.35.

Anglesmiths and blacksmiths, heavy fires, 87½ cents.

Leading men, erecting department, gang leaders, mold loft, 85 cents.

Furnace men on shapes and plates (ship work), loftsmen, first class, 82½ cents.

Operators locomotive cranes in construction work, 82 cents.

Rivet testers, 80 cents.

Flange turners, slab furnace men, patternmakers, marine leaders, crane leaders, 75 cents.

Anglesmiths and blacksmiths other fires, boltmakers, coppersmiths, marine erectors and machinists first class, fitters first class, molders, cupola tenders, loftsmen second class, plumbers and pipefitters, bitumastic painters, 72½ cents.

Levermen or cranemen, blacksmith shop; drop forgers, boiler makers, tank testers, chippers and calkers, electricians first class, joiners, machine men, joiner department; operators, locomotive, cantilever, gantry and other cranes of over three tons; rivet testers, riveters, ship carpenters first class, wood calkers, layers out, sheet metal workers, metal polishers, buffers and platers bending rollers, 70 cents.

Leaders, furnace department; crane gang leaders, 67½ cents.

Welders

Acetylene burners and welders first class, electric welders, electricians second class, fitters second class, machine men, lumber department, engineers, locomotive, operators stiff legged derricks, ship carpenters second class, 65 cents.

Marine erectors and machinists second class, marine riggers, pressmen first class, 62½ cents.

Drillers, burners second class, regulators first class, painters and polishers, cranemen, erector leaders, 60 cents.

Stage builders, mangle rollers, 57½ cents.

Anglesmith helpers, heavy fires; heaters; blacksmith's hammer runner, heavy; blacksmith's helpers, heavy fires; liner forgers, planer hands; leader cleaning department; wiremen; firemen and helpers, furnace department; strikers, furnace department; wood reamers, punchers, planers and scarfers, countersinkers, pressmen second class, offsetters, fasteners, erectors (wood), 55 cents.

Linermen, 54 cents.

Fifty Cents for Erectors

Regulators second class, 52½ cents.

Specialists or handy men (machine shop), 52 cents.

Grinders, chippers, cranemen's helpers, drop forgers' helpers, holders on, bolters, cementers, packers, reamers, hand and machine chippers, locomotive conductors, road crane conductors, hoisting and portable firemen, erectors, 50 cents.

Sawyers, 47½ cents.

Burners' and welders' helpers, anglesmiths' helpers, other fires, blacksmiths' helpers, other fires, bolt makers' helpers, liner forgers' helpers, boiler shop helpers, coppersmiths' helpers, electrical department helpers, erectors' helpers, fitting up department helpers, foundry helpers, machinists' helpers, riveters' helpers, ship shed helpers, sheet metal workers' helpers, 46 cents.

Bolters' and liners' helpers, cementers' helpers, lumber helpers, mold loft helpers, painters' helpers, 42½ cents.

Laborers, rivet heaters, boiler shop, 40 cents.

Heater boys, 38 cents.

Passer boys, 30 cents.

Layers out to receive 3 cents per hour more than first class journeymen of same department.

Oakum spinners, $2.25 a bale.

Hours of Labor Prescribed

The decision prescribes in addition to the rates of pay, hours of labor and working conditions in detail. A maximum of twelve hours is fixed arbitrarily as a day's work, to discourage excessive overtime on the ground that such overtime would lessen efficiency of workers and slow up production. In addition, the two and three shift plan will be encouraged.

Plan Periodic Adjustment of Shipbuilders' Wages

Wages will be made to keep pace with the high cost of living if the purpose of a series of conferences between representatives of the Department of Labor and the Shipping Board is realized. If satisfactory figures showing the exact advances in living cost in shipbuilding centers can be worked out, it is hoped that an arrangement can be made by which adjustments of wages will be made periodically.

Wages Outdistanced by Food Prices

Commenting upon the plan, Assistant Secretary of Labor Louis F. Post said: "Wages and food prices have been racing each other and food prices have outdistanced wages. For every two-dollar advance in wages there is a corresponding three dollars or more in the cost of living. Unless these two things can be equalized the wage-earner is going to get smaller and smaller real wages no matter how much money wages he gets. The cost of living has been advancing at least 2 percent a month, and the man who is getting the same money wages that he did a year ago is only three-fourths as well off. Unless the wage-earner can have his pay envelope stabilized in terms of what it will buy rather than in terms of money he is bound to be the loser."

Summary of What Has Been Done Since the War Began By the Shipping Board and Emergency Fleet Corporation

The following statement concerning the activities of the United States Shipping Board and the Emergency Fleet Corporation has been prepared from data furnished the Committee on Public Information by officials of the administrations named. It covers briefly the operations of these organizations since the beginning of the war.

Big Problem at Outset

At the outset of the war the nation, in addition to expanding the army to proportions adequate to wage the struggle, was confronted with the problem of providing facilities to transport its expeditionary forces and the supplies necessary to subsist them in foreign fields.

One step designed to effect this purpose had already been taken; two others followed shortly after the declaration of war. Through the shipping act, approved September 7, 1916, Congress created a United States Shipping Board to encourage and develop a naval auxiliary, a naval reserve and merchant marine; empowered that board to form a corporation to purchase, construct and operate merchant vessels, which it exercised through the incorporation of the Emergency Fleet Corporation; and authorized a $50,000,000 fund for the operation of the corporation.

Authorized by Congress

By joint resolution of the Senate and House of Representatives approved May 12, 1917, the President was authorized to take over the German vessels within the jurisdiction of the United States, its territories and insular possessions, and under the emergency shipping fund provision of the urgent deficiency appropriation act approved June 30, 1917, the President was authorized to requisition any vessels under construction or contracted for in shipyards within the United States.

By Executive orders dated June 30 and July 3, 1917, the President ordered the Shipping Board to seize the German vessels in United States waters, and by another, of July 11, 1917, delegated to the board the power of requisition which Congress had vested in him.

To perform the tasks assigned to the Shipping Board and its operating company, the Emergency Fleet Corporation, large expenditures were necessary. Congress has met the demands by supplementing the original appropriation of $50,000,000 with succeeding authorizations, which on March 1 last aggregated $2,034,000,000, to be expended for construction, requisitioning and purchasing of ships, the construction of yards and the erection of housing facilities. Of the sum authorized, $1,135,000,000 had been appropriated on March 1. The expenditures of the Emergency Fleet Corporation up to that date totaled $353,247,955.37, distributed as follows: Wood ships, $74,590,519.22; steel ships, $77,968,172.89; steel ships requisitioned, $169,971,860.55; plants, $30,717,402.71.

Seizure of Enemy Ships

Under its power of seizure the Shipping Board has taken over 112 German

and Austrian ships of 788,000 deadweight tonnage, all of which have been repaired and are now in operation.

The building programme of the Emergency Fleet Corporation is divided into steel and wood construction. Exercising its power of requisition the Shipping Board on March 1 last had taken over 425 steel vessels of 2,998,108 deadweight tons, and had let contracts for 720 steel vessels of 5,166,400 deadweight tons, making a total of 1,145 steel ships, with an aggregate deadweight tonnage of 8,164,508 tons. Of the requisitioned vessels, 72, of 485,576 deadweight tons, had been completed and put into operation; 15, of 152,290 deadweight tons, had been reconveyed to their original owners before completion, while 52 of the 338 still under construction had been launched but not completed.

Of the contract vessels, 2, of 17,600 deadweight tons, had been completed on March 1. Three others, of 26,400 tons, have been launched.

The Division of Wood Ship Construction on March 1 had let contracts for 490 wooden vessels, aggregating approximately 1,715,000 deadweight tons. None of this number has yet been completed, but 17 had been launched on March 30.

The building programme of the Emergency Fleet Corporation was being carried on March 5 in 151 plants, 85 of which were engaged on wood construction and 66 on steel. Of the 151 plants, 81 are classified by the corporation as new, having been constructed especially to take care of contracts let by the Emergency Fleet Corporation, or just as this country was entering upon the war; the remaining 70 are classified as old plants, though some of them were erected to accommodate the boom in shipbuilding that developed in the United States in the early days of the European War.

At the time the Emergency Fleet Corporation was organized practically all the ways of the yards then in existence were occupied by vessels building for the Navy Department or for private contract. This condition of affairs necessitated the construction of the 81 new yards before the building of ships for the Emergency Fleet Corporation could be commenced.

To spur the shipbuilding industry to speed up the Government work, the Emergency Fleet Corporation has extended varying degrees of financial assistance to 63 plants, the aid going to the construction of shipways, plants and the installation of plant equipment.

Supplying Ship Workers

The expanded old yards and those newly constructed had to be manned. A pressing need for skilled workmen developed. To meet the situation the Emergency Fleet Corporation organized a nation-wide campaign and established training schools for the men recruited into its service. The results achieved can be best realized by comparative figures. Census reports for 1916 show that in 45 steel yards then reporting there were only 43,582 workmen employed, while reports made to the Emergency Fleet Corporation on February 16, 1918, by 53 out of a possible 63 steel yards, give an enrollment of 162,880. The census report for 1916 from 18 wooden yards record 1,380 workmen; those of the Emergency Fleet Corporation as of February 16 last, from 59 out of a possible 75 yards, record 29,959.

The Interesting Development of "John Crane" Flexible Metallic Packing

Seldom has an engineering invention or discovery attracted so much attention and created so much interest among operating engineers as has the now well-known "John Crane" flexible metallic packing. Since this packing is now firmly established, and since the history of successful products always furnishes inspiring reading matter, it is believed that the development of this packing will stimulate other engineers to greater effort for constant betterment of power plant conditions.

"John Crane" packing was invented by an operating engineer named John Crane in the early spring of 1912. John Crane then had charge of a large power

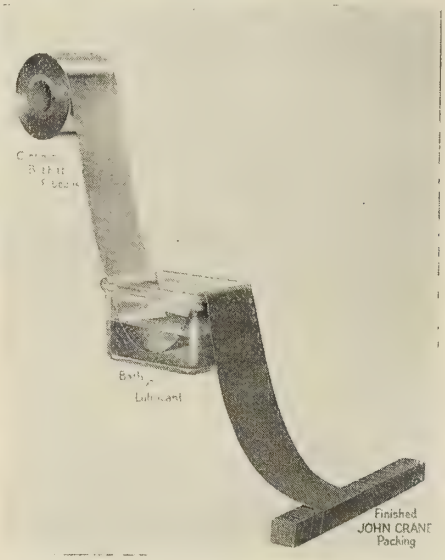


Fig. 1

plant and was directly responsible for maintenance and repair costs.

John Crane's first object was to develop a permanent packing. From actual experience with his outside-packed plunger feed pump he knew that soft packings ordinarily lasted only from four to five months, depending upon the conditions of his plungers. Of course, he desired to reduce the bills to the very minimum and, if possible, to make his packing permanent. He noticed that where metal and fabric were combined in packings, such as metal studs or metal segments, the life of such packing was lengthened. He noticed also that these metals were not affected by heat or water, while the soft packings were. And not only did he notice that the metal lengthened the life of the packings, but it seemed to polish the plunger, and hence the idea came to him of an all-metallic packing.

Flexibility and compressibility were also desirable, necessitating some mechanical combination. Of course, it was possible to take metal and shred it and twist it in the form of rope, or braid it in the form of packing. This would give the flexibility. But would it be a packing through which pressure could not pierce? Being a pioneer, he had to settle many questions with himself. So, after much thought and experimentation, John Crane evolved the idea of taking long, thin, continuous strips of metal foil and wrapping it spirally round and round, back and forth, impregnating each sheet with a layer of lubricant to permit the sheets to slide on each other and to allow bending about the smallest diameter and giving it a compressibility sufficient to compensate for wear and sufficient to control any ordinary pressure. These

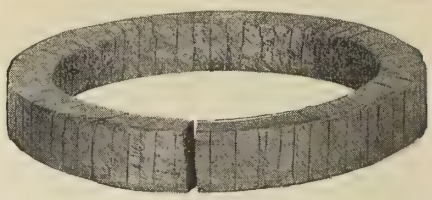


Fig. 2

spirally wrapped sheets, he found, formed perfect barriers through which pressure could not pierce and formed a strong, durable construction.

The idea of simplicity did not get away from John Crane. He had packed many stuffing boxes in his day and knew that a packing, which would be a success, must be simple to install; one that could be installed in the same stuffing boxes as soft packings and with equal ease. He, therefore, used soft metal, which could be cut with a knife, took any form or shape under pressure of the gland and bent about the plunger very easily. These features, he knew, would appeal to every experienced engineer.

Thus was John Crane's ambition realized. His analysis was correct. He was successful largely because he himself was an operating engineer and knew exactly what was needed.

"John Crane" products are now made up by the Crane Packing Company, 29 South Clinton street, Chicago, in all kinds of forms, die pressed, hand pressed, straight lengths, rings, coil form, spiralled from 1/32 inch thick to 2 inches, suitable for steam, air, ammonia,

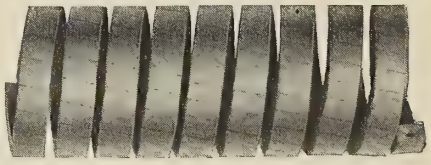
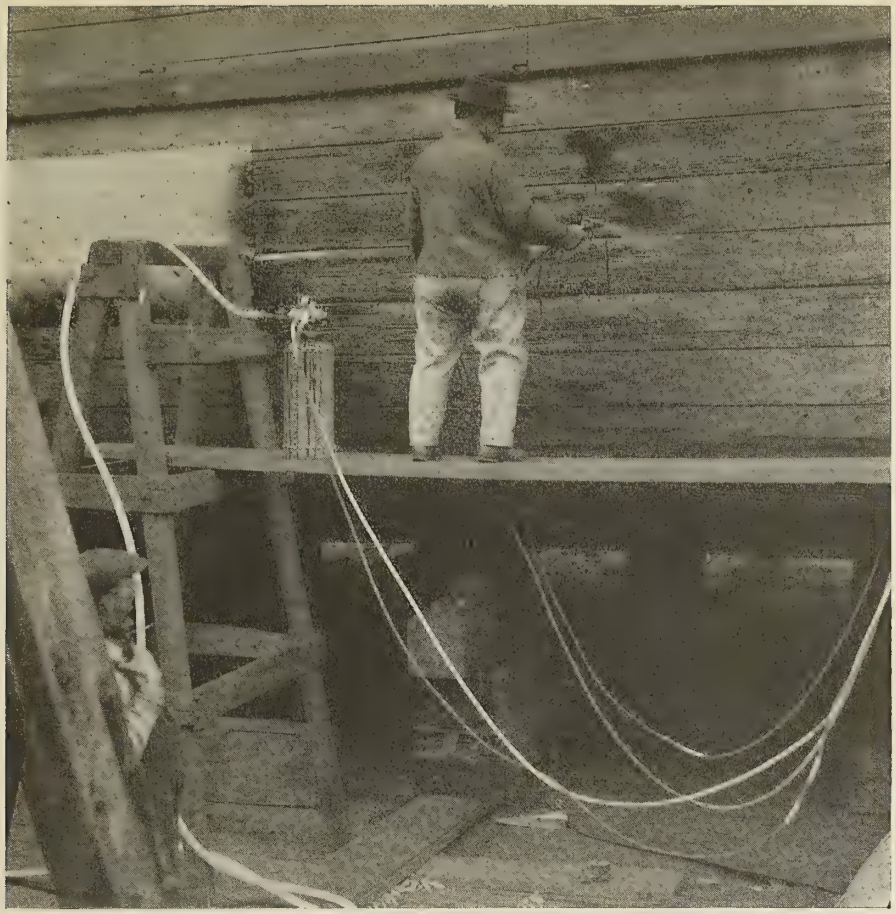


Fig. 3

hot or cold water, high or low pressure, hydraulic, oil and acid service. The "John Crane" line has been steadily developing, and to-day any combination of metal alloys for special services can be secured, either in form of a packing or in a gasket.

Fig. 1 tells the story better than any description. It is merely smooth babbitt sheets, thoroughly lubricated, wrapped spirally, forming an all-metallic, flexible, compressible, simple and lasting packing. Fig. 2 shows how "John Crane" looks in ring form and Fig. 3 shows it in coil form. Rings are generally preferred for large plungers, whereas coils are used in smaller work, as in valves, traps, small steam rods, etc.

D. M. Callis, formerly with the Maryland Steel Company at Sparrows Point, Md., and later with the Seattle Construction & Dry Dock Company, Seattle, Wash., has recently been promoted to the position of assistant Northwest district officer of the Shipping Board, under Capt. John F. Blain.



Painting a Wooden Ship With Pneumatic Spraying Apparatus

SHIPBUILDING CONTRACTS

Orders Booked for the Construction of New Ships

The United States Shipping Board has awarded an additional contract to the American International Shipbuilding Corporation for sixty steel steamships of 7,500 tons deadweight each.

The Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., J. F. Tiralla, purchasing agent, has received a contract from the United States Shipping Board to build six steel tank ships of 6.000 tons each.

The Fuller Construction Company, Fuller Building, New York, which will build a shipyard on the Cooper River, between Charleston and Mount Pleasant, S. C., has a contract from the United States Shipping Board to build twelve 9,500-ton steel steamships.

The United States Shipbuilding Company, Portland, Me., is reported to have received a contract to build seven steamships and a number of auxiliary schooners.

The East Coast Shipping Company, Boothbay Harbor, Me., Z. E. Cliff, purchasing agent, is building six three-masted, 165-foot schooners.

The Hartman-Greiling Company, Green Bay, Wis., has received a contract from the United States Shipping Board to build two steel tugs.

The Bayles Shipyard, Port Jefferson, N. Y., will build two ocean-going steel tugs for the United States Shipping Board.

The James Stewart Company, Baldwinsville, N. Y., is reported to have received a contract to build thirty 100 by 37 foot barges, to cost about $10,000 each, the equipment to include hoisting engines for handling freight.

The Terry Shipbuilding Company, Port Wentworth, Ga., will build two 10,000-ton, 500 by 135 foot dry docks, to cost about $1,000,000 each, for the United States Government.

The Manitowoc Shipbuilding Company, Manitowoc, Wis., H. A. Myer, purchasing agent, has received a contract from the United States Shipping Board to build nine more steel steamships.

The Bayles Shipyard, Port Jefferson, N. Y., L. Deyo, purchasing agent, is building four steel steamships for the United States Shipping Board.

The Greenport Basin & Construction Company, Greenport, N. Y., C. R. Brigham, purchasing agent, is building four torpedo retrievers.

The Frank V. Allen Shipbuilding Company, a new concern at Ballard, Wash., is reported to have received contracts to build wooden ships for the United States Shipping Board.

The San Francisco Shipbuilding Company, San Francisco, Cal., has received a contract from the United States Shipping Board, Washington, D. C., to build four 7,500-ton concrete ships.

The Hurley-Mason Company, Tacoma, Wash., Charles E. Hurley, president, is reported to have received a contract from the United States Shipping Board to build several concrete ships.

The Terry Shipbuilding Company, Savannah, Ga., is reported to have received a contract from the United States Shipping Board to build ten oil tank steamships of about 7,500 tons each.

The Savannah Engineering & Construction Company, Savannah, Ga., Wayne Cunningham, president and general manager, has received a contract to build seven wooden towboats for the United States Government.

The Midland Bridge Company, Houston, Tex., George E. Cole, general manager, is building six wooden hulls, with an aggregate tonnage of 21,000.

The Providence Engineering Corporation, Providence, R. I., has received a contract from the United States Shipping Board to build ten 150-foot steel ocean-going tugs.

The Skinner & Eddy Corporation, Seattle, Wash., Henry G. Seaborn, purchasing agent, has a contract to build six submarines for the Electric Boat Company, 11 Pine St., New York, for the account of the United States Navy.

The Delaware Shipbuilding Company, Seaford, Del., is building two wooden four-masted schooners for builders' account.

The Crosby Navigation Company, Richmond, Me., is building a wooden four-masted schooner and will build another as soon as the first is launched.

SHIPPING BOARD AUTHORIZES PRIVATE CAPITAL TO BUILD MOTOR-SHIPS

150 Wooden Vessels of 3,000 Tons Each to Be Built on Pacific Coast

The United States Shipping Board has agreed to permit private capital to construct 150 wooden ships of 3,000 tons each in Oregon shipyards, each ship to be equipped with Diesel engines and sails, the plan being to use them in the Pacific trade.

The arrangements are said to have been made by Senator McNary of Oregon, in behalf of the newly organized Atlantic-Pacific Corporation, behind which, it is understod, are the Du Ponts, of Wilmington, Del.

Treasury Reduces Ship Insurance Rates

It is evidence of the strongest kind of the effectiveness of the American Navy that Secretary McAdoo is again able to reduce the war risk insurance rates.

The present reduction on hulls and cargoes through the war zone is from 4 percent to 3 percent; the reduction on the officers, masters and crews of merchant vessels through the war zone is from 50 cents to 25 cents per hundred dollars of pay roll. Both reductions took effect March 18, 1918.

The first reduction of insurance rates by the War Risk Insurance Bureau was made last October, when the rate on cargoes was reduced from 6½ percent to 5 percent. The second reduction was on November 23, and was from 5 percent to 4 percent.

PERSONAL

E. P. Worden, formerly chief engineer of Henry R. Worthington Pump Corporation, has resigned to accept the position of mechanical engineer for the Submarine Boat Corporation, New York.

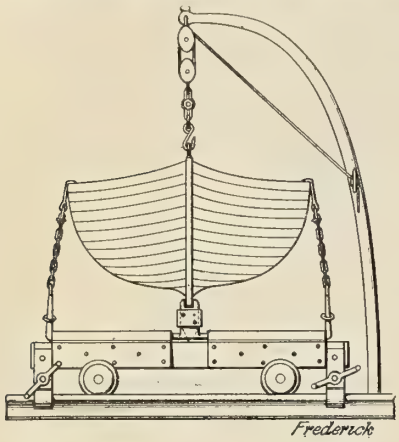
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by George A. Hutchinson, Esq., registered patent attorney, Washington Loan and Trust Building, Washington, D. C.

1,248,183. LIFEBOAT HOLDING AND LAUNCHING DEVICE. FREDERICK W. SIEVERS, OF BROOKLYN, N. Y.

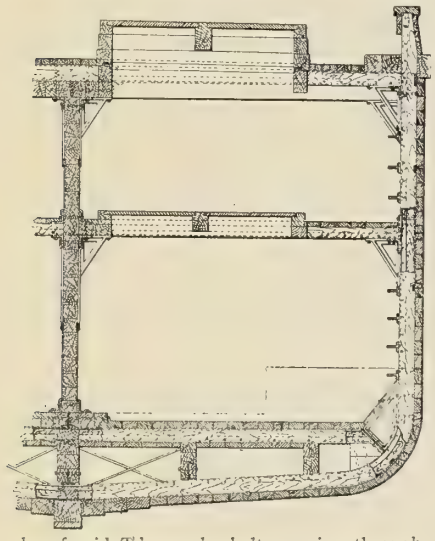
Claim 5.—The combination of a truck, a lifeboat, supporting blocks having pointed lower ends resting on the truck and on the top surfaces of which the keel of the boat rests, rock



shafts on the truck, arms on the shafts, yokes on the arms for normally holding the blocks upright, and means for releasably holding the shafts with the yokes engaged with the blocks, said arms having recesses to engage the keel of a boat when the arms are upright. Seven claims.

1,249,173 NAVAL CONSTRUCTION. LUTHER STRINE MUNSON, OF LONG BEACH, CAL., ASSIGNOR OF ONE-HALF TO THOMAS J. EVANS, OF LONG BEACH, CAL.

Claim 1.—A marine vessel having a steel framework comprising a series of T-beams connected together, wooden timbers secured to the



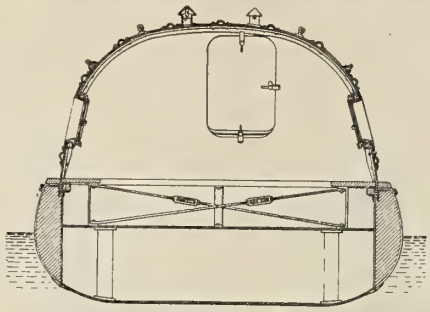
webs of said T-beams by bolts passing through said webs, and planking secured to said beams by bolts passing through the flanges of said T-beams and said timbers. Ten claims.

1,222,867. VESSEL BULKHEAD. ARCHIBALD HOGG, OF WALKER, NEWCASTLE-UPON-TYNE, ENGLAND.

Claim 1.—A bulkhead construction for ships comprising a transverse bulkhead formed of flat plates and curved plates disposed so that the curves of adjacent plates are reversed, the flat plates lying at the edges of the bulkhead parallel with the crests and valleys of the curved plates, the arc of each plate curve being limited in extent to not more than one-third of a circle and the width distance between adjacent curve crests exceeding four times the depth distance from crest to reversed crest, flanged joints between said plates and curved plates, and a continuous four-sided boundary frame comprising at least one angle bar, two sides of said frame being formed with broad shallow undulations which enter the undulations of the curved plates of the bulkhead, said frame being attached on all four sides both to the bulkhead and to the hull of the ship, all as set forth in the specification. Six claims.

1,249,645. LIFE-BOAT. ANDREAS P. LUNDIN, OF BAYSIDE, N. Y.

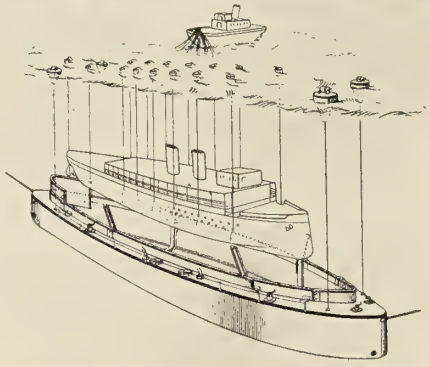
Claim 1.—A life boat embodying a hull having a well and a housing erected above said well, entrance and exit ports provided with



watertight closures, side ports having row-lock notches formed in their lower edges and a glazed watertight closure for each of such side ports and notches. Three claims.

1,250,787. MEANS FOR RAISING SUNKEN VESSELS. GÉDÉON BREAULT, OF PAWTUCKET, R. I.

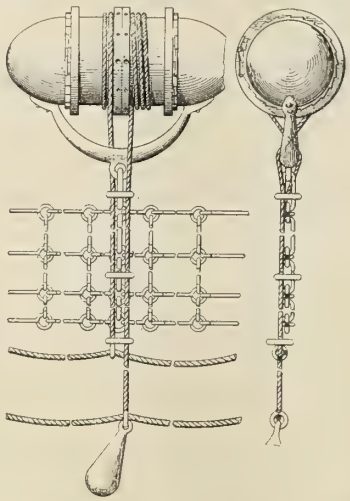
Claim 1.—A floating dry dock comprising an outer hull, an inner casing spaced from the hull, a deck holding the inner casing in spaced relation, partitions for dividing the space between the hull and the inner casing into com-



partments, a valve for permitting the entrance or exit of water from each compartment, means for operating each of said valves individually, means for forcing compressed air into or permitting the withdrawal of air from each compartment individually, and U-shaped guide members spaced within the inner wall, the upper ends of said U-shaped guide members being outwardly flared. Four claims.

1,251,326. TRAWLING DEVICE. GEO. FELL, OF OROVILLE, CAL.

Claim 1.—A trawling device comprising a net; means for suspending the net from the



surface of a body of water; a pair of horizontally disposed cables operatively connected to the suspending means; and means for independently altering the distance between each cable and the net. Fourteen claims.

1,205,766. BOAT-LAUNCHING DEVICE. ALLEN E. J. LUCKHURST, OF RIDGEWOOD, N. J.

Claim 1.—In a boat launching device, gearing mounted on the davit adapted to rotate the same, means carried by said davit to operate said gearing, and means independent of any operating parts to hold said operating means in fixed relation to the ship. Nine claims.

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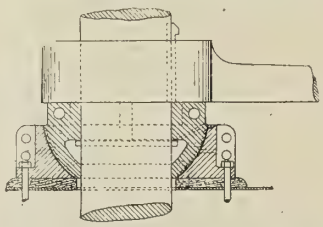
110,002. "IMPROVEMENTS IN AND RELATING TO SHIPS' RUDDERS." C. A. JACKSON, SUNDERLAND.

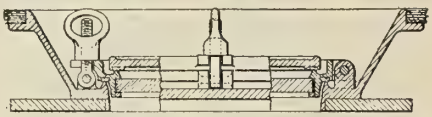
A rudder carrier or bearing in accordance with this invention is characterized in that the deck plate or ring is formed with a part spherical bearing surface adapted to receive and support a corresponding part spherical bearing sur-



face on the stock ring and is further characterized in that the stock ring is provided with a cavity or cavities for lubricant and with means for forcing out said lubricant through suitable passages onto the bearing surfaces.

110,510. "IMPROVEMENTS IN OR RELATING TO SIDE SCUTTLES FOR SHIPS." R. G. CERVIN, OF STOCKHOLM, SWEDEN, AND B. SILFVERLING, OF ARBOGA, SWEDEN.

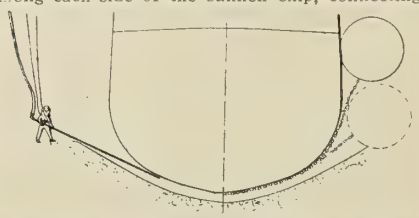
Scuttles usually consist of a window hinged in a frame firmly connected to the outside plating, the space between this frame and the ceiling inside the outside plating being usually filled up with wood in such a manner that a funnel-shaped aperture is formed. Experience



has, however, shown that this arrangement is not at all satisfactory, because the water and the moisture from the scuttles without difficulty make their way between the outside plating and the ceiling, thus causing the corrosion of the former below the scuttles, making it necessary often to inspect this part of the outside plating. According to the present invention, the frame is united or made in one piece with a flange extending from the frame to the ceiling, and is preferably of an annular, conical shape, thus preventing the water from the window from making its way between the outside plating and the ceiling. Hereby the inconvenience above stated is removed.

109,097. "IMPROVEMENTS IN OR RELATING TO THE RAISING OF SUNKEN VESSELS, SHIPS AND OTHER SUBMERGED OBJECTS." A. G. MIDFORD, OF OTTAWA, CANADA.

This invention relates to the method of raising sunken ships and other submerged objects, which consists in sinking caissons or air vessels along each side of the sunken ship, connecting



them together by means of chains or the like passed through channels beneath the ship, and then admitting compressed air to the caissons. An essential feature of the invention consists in the improved manner in which the openings or channels in the soil beneath the ship are formed for the reception of the chains, by boring means adapted to permit of hydraulic or pneumatic pressure being applied alternately and successively to the subsoil, said means being worked from either side and the chains being passed beneath the ship prior to connecting them to the yoke-pieces on the caisson.